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U. S. DEPARTMENT OF AGRICULTURE.

DIVISION OF AGROSTOLOGY.

[Grass and Forage Plant Investigations.]

A REPORT

UPON THE

FORAGE PLANTS AND FORAGE RESOURCES

OF THE

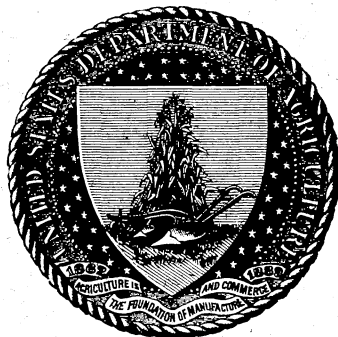
GULF STATES.

BY

S. M. TRACY,

Formerly Director of the Mississippi Agricultural Experiment Station.

PREPARED UNDER THE DIRECTION OF THE AGROSTOLOGIST.



WASHINGTON:

GOVERNMENT PRINTING OFFICE

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LETTER OF TRANSMITTAL

U. S. DEPARTMENT OF AGRICULTURE,
DIVISION OF AGROSTOLOGY,

Washington, D. C., July 15, 1898.

SIR: I have the honor to transmit herewith, and recommend for publication as Bulletin No. 15 of this Division, a report by Prof. S. M. Tracy, of Mississippi, on the Forage Plants and Forage Resources of the Gulf States east of Texas. This report is in line with the investigations of the grasses and forage plants of the South now being carried on by this Division.

The grazing and forage problems in the South are of great importance; keen competition is compelling the adoption of a more diversified system of agriculture than has existed in the past. Fine cattle and good milk and butter are more profitable than cotton, and there is an increasing demand for good hay and pasture grasses and other forage crops. The climate is excellent for the growth of many kinds of grasses, and the soils are for the most part good or readily susceptible of care and cultivation.

There are between 300 and 400 species of grasses in the five Gulf States east of Texas. One observer has found in the State of Alabama alone 255 kinds. A large proportion of these grasses are unknown in the Northern and Western States, being peculiar to the Gulf coast region. This abundance of native grasses indicates that the South is naturally a good grass country, and there are wide areas in each of these States which may be profitably devoted to the formation of meadows and pastures.

The value and adaptability of these many kinds, and of foreign sorts as well, to special purposes, or to local conditions, ought to be systematically investigated. The work of determining the most practical methods of introducing and cultivating those grasses which are most likely to succeed and which will at the same time be best suited to meet the needs of the stock raisers and dairymen, has been approved by you, with instructions to this Division to begin an investigation of the grasses and forage plants and forage problems of the Gulf States. Particular attention will be given to noting the abundance and value of the native forage plants and the possible methods to be employed in maintaining or improving the existing conditions of pasturage and forage supplies. A circular letter requesting information relative to the points involved

in the investigation was sent to parties interested in the work proposed, and many replies containing much valuable information bearing on the subject have been received.

In connection with the preparation of the present report, Professor Tracy made a large collection of the native Southern grasses, and furnished the Division much valuable information relative to the prevalence and distribution of the species. The data thus acquired, together with that afforded by collections in the National Herbarium, will be used in preparation of a list of the grasses of the South, while the information contained in the replies to the circular letters above referred to will be used in the compilation of a report of a more practical nature.

The illustrations for the present bulletin have been carefully selected by the Agrostologist from the drawings prepared under his supervision.

Respectfully,

F. LAMSON-SCRIBNER,

Agrostologist.

Hon. JAMES WILSON,

Secretary of Agriculture.

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FORAGE PLANTS AND FORAGE RESOURCES OF THE GULF STATES.

INTRODUCTORY.

Until within the last fifteen years it was commonly believed that good pastures did not exist in the Gulf States of Louisiana, Mississippi, Alabama, Georgia, and Florida, and that good hay could not be made in that region. With rare exceptions the pastures used were composed of the wire grasses and broom sedges of the pine woods, and the larger part of the hay which was found on the market, even in the smaller towns, was brought from the North.

The work which has already been done by the United States Department of Agriculture, together with that of many intelligent planters, has demonstrated that the soil and climate of the Gulf States are such as will produce a heavy yield of forage, and that the quality of Southern-grown hay is fully equal to that of any which can be imported from other localities.

SOILS OF THE GULF STATES.

The soils of the Gulf States, excepting a small area in northern Alabama and Georgia, are all alluvial. They may be subdivided into six quite distinct sections with quite different types of soil. These are:

(1) The treeless prairie region of southwestern Louisiana.

This region is mostly low, intersected by numerous rivers and bayous, and the soil, a sandy loam, is of wonderful fertility.

(2) The Gulf coast region, including a narrow strip along the coast from Louisiana to Florida.

This region has a rather sandy soil, often quite light on the immediate coast, but becoming more loamy and usually underlaid with a heavy clay formation a few miles back from the beach.

(3) The pine woods region, extending from central Louisiana eastward to Georgia and northern Florida.

The soil in this region is usually a sandy, easily worked loam underlaid with clay, becoming lighter toward the South, where it merges into the alluvial soil of the coast district.

(4) The clay loam region of the upper or northern section, extending from northern Louisiana to central Georgia.

In this region the pine growth is more or less mixed with oaks, hickories, and other deciduous trees. The soil is variable, being rich and fertile along the creek bottoms, but harder, drier, and often somewhat sterile on the hills. These lands often suffer seriously from washing.

(5) The black prairie region of northeastern Mississippi and western Alabama.

The soil in this region is black, rich in lime, and affords some of the best grass lands in the South.

(6) The river bottoms.

While five of the divisions or regions named above are in irregular belts extending from west to east, all are crossed by rivers, the Red, Mississippi, Pearl, Tombigbee, Chattahoochee, and others, which flow in a southerly direction. Much of the land along these rivers is of very recent formation and is quite different from that of the neighboring hills. It is generally extremely fertile, but often suffers from overflows and for want of drainage. In each of these regions wide variations of soil may be found, and these differences occur sometimes on a single farm.

NATURAL PASTURES.

The natural forage plants vary as widely as the soils. Some adapt themselves to almost any situation and are quite general in their distribution, while others are extremely local; some become more vigorous and abundant under frequent grazing, while others soon disappear with any change of surroundings.

The natural pastures of the Gulf States are composed largely of such grasses (fig. 1) as are native to the more or less open pine woods, while along the streams and roads many foreign grasses and legumes (clovers or beggar weeds) have become thoroughly naturalized and add very materially to the value of the range. Of native forage plants not less than 350 species and varieties of grasses alone have been identified. Of that number, 25 yield fully 75 per cent of the grazing. Fully 90 per cent of the natural grazing is afforded by not more than 30 species. Of the 12 or 15 naturalized and widely distributed species the proportion of valuable sorts is much larger, as only those which are able to thrive in this soil and climate and make places for themselves on ground already occupied by native species could become established without assistance.

The best native pastures are those of the prairie region of Louisiana, where the soil is fertile, the climate favorable for an almost continuous growth, and where there are no trees to shade the ground or to appropriate the moisture and nourishment necessary for the growth of abundant and nutritious herbage. There the *Paspalums* are the characteristic and most abundant grasses, carpet-grass (*P. compressum*), large water-grass (*P. dilatatum*), smooth water-grass (*P. lentiferum*), and slender paspalum (*P. setaceum*) being the most common species

on the wild prairie, while on lands which have been grazed for a considerable time carpet-grass occupies a large portion of the ground and makes a vigorous growth. Among other grasses which are abundant in this region are Munro-grass (*Panicum agrostoides*), narrow-leaved panic-grass (*P. angustifolium*), barnyard-grass (*P. crus-galli*), mutton-cane (*P. dichotomum*), sprouting crab-grass (*P. proliferum*), Colorado grass (*P. texanum*), switch-grass (*P. virgatum*), gama (*Tripsacum dactyloides*), silver-beard (*Andropogon argyræus*), Elliott's broom sedge (*A. elliottii*), big blue-stem (*A. provincialis*), little blue-stem (*A. scoparius*), sedge wire-grass (*Aristida palustris*), redtop (*Agrostis vulgaris*), and shining-love-grass (*Eragrostis nitida*).

The pastures of this region, unlike those of most other sections, improve under rather heavy grazing on account of the unusual abundance of water-grasses. Dr. Knapp, of Lake Charles, La., states that while the wild lands will support one cow on about three acres, old pastures will give good grazing for a cow on one acre, and he has kept two cows per acre in good condition during nine months of the year.

The natural pastures along the alluvial lands of the Red, Mississippi, and other rivers are exceedingly variable, both in quality and in variety of plants. The tree growth is usually so dense that ordinary grazing plants will not grow excepting in open places, and the cane (*Arundinaria*) is the only true grass which is able to hold its place. In many localities this forms extensive "canebrakes" which furnish, both winter and summer, grazing for thousands of cattle. Too heavy grazing soon kills the cane, and it is seldom renewed. Along the borders of streams and swamps, and wherever the sun can penetrate, Munro-grass, flat-stemmed panic-grass (*Panicum anceps*), barnyard-grass, switch-grass, many-flowered love-grass (*Eragrostis glomerata*), fall redtop (*Triodia seslerioides*), large water-grass, smooth



FIG. 1.—Characteristic Southern grasses. (a) *Elymus virginicus*; (b) *Paspalum ovatum*; (c) *Panicum virgatum*; (d) *Panicum agrostoides*; (e) *Panicum viscidum*; (f) *Phalaris angusta*; (g) *Danthonia compressa*.

paspalum (*Paspalum lave*), and slender paspalum, together with two or three species of vetches, add largely to the grazing. When the lands have been grazed for a considerable time the species of *Panicum*, *Eragrostis*, and *Triodia* disappear and are replaced by carpet-grass, where the soil is sufficiently sandy, and by Bermuda and redtop on heavier soils.

In the uplands of the northern pine region of Louisiana and Mississippi the sedge-grasses, wire-grasses, and panic-grasses form a large part of the natural growth. Big blue-stem, little blue-stem, and broom-sedge (*Andropogon virginicus*), branching triple-awn-grass (*Aristida dichotoma*), prairie triple-awn-grass (*A. oligantha*), purplish triple-awn-grass (*A. purpurascens*), slender paspalum, and prairie-grass (*Sporobolus asper*) are among the more common species on the hills, while along the streams large water-grass, Terrell-grass (*Elymus virginicus*), cane, and gama are more abundant. Under continued grazing many of these, especially the broom-sedges and wire or needle grasses, disappear and are largely replaced by Bermuda and lespedeza. When grazed too closely even these become so weakened that they fail to hold the ground against the worthless and aggressive bitter-weed (*Helenium autumnale*). Where the soil is rich in lime, as in the black prairie region of Mississippi and Alabama, sweet clover soon establishes itself and becomes one of the most important of the naturalized species.

Much the same conditions obtain farther to the eastward, in northern Alabama and Georgia, the wire-grasses (species of *Aristida* and *Sporobolus*) forming a large part of the natural growth; while bunch-grass (*Andropogon tener*) grows thickly on the sandy hills, and prairie-grass, rush-grass (*Sporobolus junceus*), and southern poverty-grass (*S. vaginiflorus*) are common on the more clayey soils.

In the long-leaf pine region along the Gulf coast the number of species, both of the true grasses and of other forage plants, is much larger than farther north, and as the woodlands are mostly open and with very little undergrowth, the natural pastures are better than in some other sections. Panic-grasses, water-grasses, and sedge-grasses are abundant, and several species not found in other sections assume considerable importance here. Fringe-leafed paspalum (*Paspalum ciliatifolium*), large water-grass, smooth paspalum, carpet-grass, slender paspalum, Munro-grass, flat-stemmed panic, mutton-cane, switch-grass, creeping beard-grass (*Opismenus setarius*), smooth foxtail (*Chætochloa lavigata*), Elliott's broom-sedge, brook-grass (*A. glomeratus*), big blue stem, bunch-grass and broom-sedge, branching triple-awn-grass, slender triple-awn-grass (*Aristida gracilis*), purplish triple-awn-grass, swamp poverty-grass, Muhlenberg's hair-grass (*Muhlenbergia capillaris*), prairie-grass, rush-grass, and *Triodia ambigua* are among the more prominent species. Branching panic-grass in its several varieties, and here known as "mutton-cane," is, perhaps, the most abundant of any single species, continuing its growth throughout the entire year and furnishing the bulk of the grazing for thousands of sheep and cattle which

winter in the woodlands. Continued grazing destroys many of the wiregrasses, which are largely replaced by water-grasses, mutton-cane, Japan clover or lespedeza, and Bermuda.

Immediately along the coast and on the adjacent islands there are a number of conspicuously abundant species, though limited in range to the immediate vicinity of the water. Among these are bitter panic (*Panicum amarum*) and creeping panic (*P. repens*), seaside finger-grass (*Chloris petraea*), St. Augustine grass (*Stenotaphrum dimidiatum*), salt grass (*Distichlis spicata*), and creek-sedge (*Spartina stricta maritima*). In the salt marshes wild-rice millet (*Zizaniopsis miliacea*), Munro grass, and switch-grass are abundant, while giant millet (*Chaetochloa magna*) and barnyard-grass often make immense growths. Among other native forage plants abundant in this region are low killinga (*Killinga pumila*), which often covers considerable areas and is the most valuable of the sedges for summer grazing, wild bean (*Vigna glabra*), with its pea-like growth, and Florida beggar-weed (*Desmodium tortuosum*) on the more sandy soils. When the field is grazed so closely as to weaken the growth of the sedge-grasses and wire-grasses, carpet-grass takes possession of the Southern pasture.

As a whole, the native pastures of the Gulf States contain a much larger number of species than do those of the North, and so furnish excellent grazing while they last, but many of them soon become so weakened by constant grazing and trampling that they finally give place to worthless weeds or leave the ground bare, to be washed and gullied by the winter rains.

THE FORMATION OF PASTURES.

With a climate favorable to an almost continuous growth, and with soil easily worked and promptly responding to good management, it is not difficult to secure permanent pastures of the highest quality; but in order to obtain the best returns, the same intelligent care must be used in their preparation and management as are given other portions of the farm.

The best pastures are those which contain the greatest variety of plants yielding palatable food for stock. These plants should be such as make their greatest growth at different seasons, in order that there may be a continuous supply; a portion of them should be legumes, both for their superior fattening qualities and for their effect on the soil, and as large a proportion as possible should be perennials. Such a pasture can not be made in one season, but requires time for its best development, and when once secured its value and feeding capacity will increase yearly under good management.

Excellent pastures are sometimes made from the natural sod, but in most cases it is more satisfactory, and in the end less expensive, first to plow the ground and use it two or three years for corn or cotton, which will kill the wild broom-sedges and wire-grasses and change the

character of the soil so that the cultivated grazing plants will be able to establish themselves so thoroughly as to prevent the growth of other and less desirable sorts. The prairie lands of Louisiana make excellent pastures without plowing, and the thin, sandy lands along the Gulf coast can be made into very satisfactory pastures simply by grazing to destroy the wire-grasses and to encourage the growth of carpet-grass. The coming in of the carpet-grass can be materially hastened by mowing an old pasture in July or August when the grass is maturing its seed and scattering the hay over the new field. Wet places should be planted with either roots or seed of the large water-grass, which grows well in such places and is especially valuable during winter. Many of the coast soils are so deficient in lime that it is difficult to secure a good growth of any of the clovers. Where the soil is not too light, lespedeza will do fairly well, and as its growth improves year after year, it pays to sow it in all pastures. On light soils which contain lime, like many of those in southern Georgia and Florida, the Florida beggar-weed grows well, reseeds itself freely, and makes good summer and fall grazing, but yields nothing during the winter and spring months. It is very little trouble to make good pastures on the coast soils which have once been in cultivation, as carpet-grass takes possession of such fields very quickly. Bermuda will cover the more fertile spots, and the sowing of lespedeza or beggar-weed will provide the best leguminous grazing plants for these soils.

Rich and moist alluvial soils, like those along the rivers and large streams, will finally become covered with a growth of Bermuda grass, but even on such lands the spread of the grass is slow, and the ground can be covered much more quickly if it is first plowed to kill the coarser growth and bring it into better mechanical condition. These soils make better pastures than do any other, as they are naturally the most fertile, most easily kept in condition, and will support a greater variety of plants. For these, as for all fertile soils, Bermuda is the best possible foundation, and should be planted as described on page 25, but as its season for good grazing lasts only six or eight months, it should have other species planted with it. Large water-grass and Terrell-grass will give good winter grazing along the water courses and in damp places, while bur-clover and lespedeza should be sown on the drier portions. Along creeks, the borders of marshes, and other wet places redtop and alsike clover should be sown at the rate of a bushel of the former and two quarts of the latter per acre. On black soils four quarts of red clover seed may be added with advantage.

On the drier and harder upland soils it is almost impossible to secure good pastures without previous cultivation of the land. The natural pastures in this region are all that can be desired during the summer and early fall, but fail quickly after the first frosts and do not become really good again until April. Here, as elsewhere, Bermuda and lespedeza are the best foundation for a pasture, as both make vigorous

growths and both are permanent, although neither is of much value during winter or spring. No grazing plant has been found which will make a satisfactory winter and spring growth on the dry, hard, clay hills of this region, and such localities can be depended upon for summer and fall grazing only.

On the seepy hillsides and on the lower lands the grazing season may be greatly extended and good permanent pastures are not hard to make by the use of the same plants which have been recommended for the alluvial soils. Bur-clover does well on these soils, and in many places wild vetches are abundant, beginning their growth in the early winter and making good grazing by February or March.

On moist lime soils, especially where partially shaded, Kentucky blue grass does well, but it is of no value on the light colored or on the red clay soils. Where the soil is somewhat sandy, old fields are often made into pastures by mowing carpet-grass and scattering the hay over the knolls and hilltops in the fall, and following this with lespedeza seed in the spring. It costs but little to seed a pasture in this way, and it is often the best plan to follow. The ground is sure to be covered with a good growth of crab-grass the first year, and by the second year the carpet-grass and lespedeza will be scattered over the entire field. In the "cane-hill" region of northern Louisiana and southern Mississippi this is the more common method of making pastures. On many farms temporary pastures with annual plants in rotation with cultivated crops are more economical and satisfactory than are permanent pasture fields.

Farther eastward, on the clay uplands of Alabama and Georgia, good permanent pastures are still more difficult to secure. When the sparse natural growth of wire-grass and broom-sedges has disappeared, better grasses fail to take their places, and the land produces only a scant growth of poverty weed with a little thin fescue in early spring, with fall panic and similar grasses later in the season. The bottom lands of this section, however, make fine grazing lands and are capable of producing a great variety of plants, both true grasses and legumes. Bermuda gives the bulk of the grazing, but redtop, Canadian blue grass, lespedeza, bur-clover, and the vetches all do well. In some places Texas blue grass flourishes and makes a heavy yield for winter grazing.

Farther south, on the immediate Gulf coast and in the greater part of Florida where the growing season is practically continuous, Bermuda is largely replaced by carpet-grass, while fewer perennials and more annuals are used to add to the yield and variety. Crab-grass and Mexican clover are everywhere in cultivated fields from which the crops were removed by midsummer, and on many of the native pastures beggar-weed is the predominant growth. In the larger part of this region only a very small proportion of the land is in cultivation, so that cattle have such an abundant range in the woods that the need of permanent pastures has scarcely been felt as yet, and but little attention has been

given to the cultivated grazing plants. Judge J. M. Jones, of Florida, states that on the natural ranges and in the old fields cattle will make a good gain for six months, about hold their own for three months, and will need feeding during the other three months to keep them in good condition. As the proportion of cultivated lands increases, the ranges and permanent pastures will become as important in Florida as elsewhere.

In the black prairie district of Mississippi and Alabama good pastures can be made with but little trouble by the use of Bermuda, lespedeza, and melilotus, with redtop and alsike for the wet soils.

THE ESSENTIALS OF A GOOD PASTURE.

In general, the making of a good permanent pasture is a more difficult matter in the South than in the North, as it is necessary to provide for a longer grazing season. There is no one grazing plant which continues in active growth through the entire year, and the best growth of most species is made in the course of three or four months. Some make nearly their whole growth in the early spring months, others do not begin their growth until late and continue to grow until killed by frost, while still others begin their growth with autumn rains and mature their seed in the early spring. When one species has completed its growth, or becomes dormant for a few months, others are ready to take its place at once, and so a constant succession is maintained.

SELECTION OF VARIETIES.

With such constant changes it is often difficult to select species for a mixture, each of which will hold its own without overgrowing weaker species or being crowded out by its stronger neighbors. The best plants for permanent pastures must be either perennials, or annuals which reseed the ground freely and surely. They must be adapted to soils of widely different character, their roots must be able to endure continued drought, and they must be palatable to all kinds of stock. No one species will cover and hold the ground throughout the whole year, and so it is necessary to use a mixture of several kinds, at least one of which should be a legume, and it is difficult to arrange these mixtures so that they will be suited to the widely varying Southern soils, or even to the different soils which are usually found on a single farm. Whatever may be planted will usually prove to be only the foundation of the pasture, as every locality has native or naturalized species which will finally occupy a considerable portion of the ground, and often some of these self-introduced sorts will prove as valuable as many of those which have been introduced and deliberately planted. For the whole of the Gulf States, excepting the sandy soils near the coast, Bermuda and Japan clover should be the foundation of every permanent pasture. On alluvial lands add redtop and alsike clover for the damper soils, with orchard grass, sweet clover, and bur clover for the drier lands. On the uplands, yellow loam, and clay sections, orchard grass and bur clover do well on the dry soils, while for wet

places redtop, large water-grass, and alsike clover should be added. For the black prairie region Texas blue grass and sweet clover are the best additions. On the light soils of the coast region carpet grass, large water-grass, giant beggar-weed, and mutton-cane largely replace the redtop and clover of more Northern sections.

CARE OF PASTURE LANDS.

When a satisfactory permanent pasture has been secured, it needs the same care and attention which are given to other parts of the farm. Heavy fertilizing is seldom necessary, though an occasional application of cotton-seed meal and muriate of potash are profitable for stimulating a better growth on thin spots. The most common injury to pastures is that caused by being grazed too closely. When grazed so closely as to leave the surface of the ground partially exposed and to weaken the roots of the grasses, rolling lands are often seriously injured by washing. Small washes are easily stopped by driving in a few stakes and banking around them with Bermuda sods. On clay soils the presence of bitterweed is a sure indication that the land has been overpastured. It is practically impossible to destroy the weed by digging or mowing, and the best treatment for a pasture in which it has made its appearance is to fertilize liberally and graze it less heavily, when the weed will soon disappear. It is never troublesome in fertile pastures which are not overgrazed.

TEMPORARY PASTURES.

In a region where it is so difficult to secure perennials for permanent pastures, and where the growing season is so long that two or more crops can be grown on the same land yearly, temporary pastures of quick-growing annuals will always be largely used, and in many sections will afford the most economical grazing for different seasons. Fields from which oats, melons, potatoes, and other early crops have been removed make fine pastures from July until the end of summer. Cornfields in which cowpeas have been planted make the best of fall grazing, while oats and vetches make abundant and nutritious winter feed. These can be grown on land from which early crops have already been taken. They cost nothing but the seed and the sowing, and on many soils heavy volunteer crops give fine grazing for three or four months with absolutely no cost. Under such conditions temporary pastures are not makeshifts, but are an important part of a well-arranged rotation.

The most valuable plants for summer and fall grazing are crab-grass, crowfoot, Mexican clover, and Florida beggar-weed, all of which make volunteer growths so late in the season as not to interfere with other crops, and will cover and protect fields which would otherwise be idle. Crab grass is abundant everywhere in cultivated land. Crowfoot is rare in the northern and western sections, but is common southward

from the beginning of the sandy pine region in Alabama and Georgia, and often covers the ground as thickly as does crab-grass in other sections. Mexican clover is abundant only near the coast, where it is usually found in fields with crab-grass, but is valued less for grazing than for hay. Beggar-weed is more abundant in Florida than elsewhere, though fields containing a mixed growth of that plant, crab-grass, and crowfoot are often seen in southern Alabama and Georgia. Beggar-weed has been sown in many localities in the coast region, but does not seem to have gained the foothold elsewhere that it has in Florida. Where it does do well it is regarded as the most valuable plant for summer and fall pastures. It is eaten by all kinds of stock and is fattening, but it is said that horses and mules can not stand hard work without other feed.

For later grazing the same plants may be used, and cowpeas and chicken corn, together with pickings from the corn and hay fields, make the fall pastures rich and varied in favorable seasons; but in seasons of severe drought they often become dry and poor, and it is in such seasons more than at any other time that silos and soiling crops are needed. Although cowpeas do not bear grazing well they make the best of feed, and are often more profitable when used for pasturage than when used in any other way. The droppings from the grazing animals are left in the field and serve to maintain the fertility of the soil. On very light or sandy soils the plowing under of the vines is less beneficial than the trampling of the stock and the addition of the manure. While it is more profitable to cut the vines for hay when grown by themselves, pasturing them is usually better when they are grown in cornfields. The fertilizing value of the crop is worth more than the cost of the seed, so that the pasturage is all clear profit. Chicken corn is more abundant in the black prairie region than elsewhere, and makes its growth late in the season after corn is nearly matured. Being a volunteer crop, it costs nothing and is worth nearly or quite as much as sorghum for grazing purposes. A good grazing plant which will bear the autumn drought without injury would be a great boon to the Southern stock raiser.

WINTER PASTURES.

For winter grazing, oats, rye, barley, and hairy vetch are the most successful crops, and a mixture of "turf oats" and hairy vetch has given more satisfactory results than has any other winter-grazing crop which has been tested. The turf oats are more hardy than are most other varieties, never having been injured by cold in central Mississippi or Alabama. They stool very freely, often sending up 100 or more stems from a single root, and they bear close and long-continued grazing without injury. For winter grazing they should be sown as early as October, though December sowing may be made for early spring feed.

These oats ripen later than do other varieties, and the yield of grain is about the same. Ordinarily they are entirely free from rust, though

when on low and wet ground they sometimes suffer from that disease. The vetch grows best on a rich and heavy soil, does fairly well on rather thin clay lands, but is worthless on light soils. When sown with turf oats, it makes but little show in early winter, but from January onward it nearly doubles the amount of grazing and does not interfere with the growth of the oats. Mr. E. R. Lloyd, the agriculturist of the Mississippi experiment station, says: "This is the best combination I have ever seen for winter grazing, and our farmers are beginning to realize its value. On the bottom land where we grew the mixture last year we grew a crop of peas during the summer, with a view to killing out the Johnson grass. This fall there is very little of the Johnson grass to be seen, while the oats and vetch came up well after the first fall of rain, without reseeding. The field is now (November 14) very green and would make fine grazing." On good soils the mixture may be grazed from November to March, when, if the stock be taken off, it will make fully a ton of fine hay per acre by the last of May. If grazed continuously until June, it will usually reseed the ground sufficiently for a crop the following season, though the volunteer oat crop is rather uncertain.

MEADOWS.

Bermuda, Johnson grass, and cowpeas furnish fully three-fourths of the hay used in the Gulf States. A dozen or more other species are used to some extent, and a still larger number might be advantageously cultivated. Much of what has been said in regard to permanent pastures applies equally well to the formation of permanent meadows. The more important of the grasses and forage plants used in the formation of such meadows are described below.



FIG. 2.—Alfalfa (*Medicago sativa*).

ALFALFA.

Alfalfa (fig. 2) is rapidly growing in favor, especially on well-drained alluvial soils, where it gives repeated cuttings and improves with age. On the rich soils along the Red and Mississippi rivers it is especially valuable, and it is also succeeding well in many places along the Gulf

coast from Louisiana to Florida. It is not often successful on the yellow or red clay uplands, but is very promising on the strong lime soils, even where the rotten limestone rock comes within a few inches of the surface.

Alfalfa is often grown on lands which are seeded to Johnson grass, and in such fields the yield of hay is very large, from 3 to 5 tons per acre of very fine quality. Such fields make very satisfactory and profitable meadows for a few years; but as the Johnson grass needs an occasional

plowing, which can not be given without killing the alfalfa, the latter must be resown each time the land is plowed.

BERMUDA GRASS.

In the region in question no grass is used more largely for hay than Bermuda (fig. 3). After a meadow has been in this grass some years the sod becomes so matted with roots that the growth is lessened, and it should be plowed or cut with a disk harrow, in order to give the grass a fresh start. If plowed in the fall, after the last cutting has been made, the field should be sown with oats, vetches, or a mixture of the two. As the sod is very tough, it should be thoroughly harrowed both before and after the seed is sown, and, if possible, finished with a roller, so as to leave the surface smooth for the

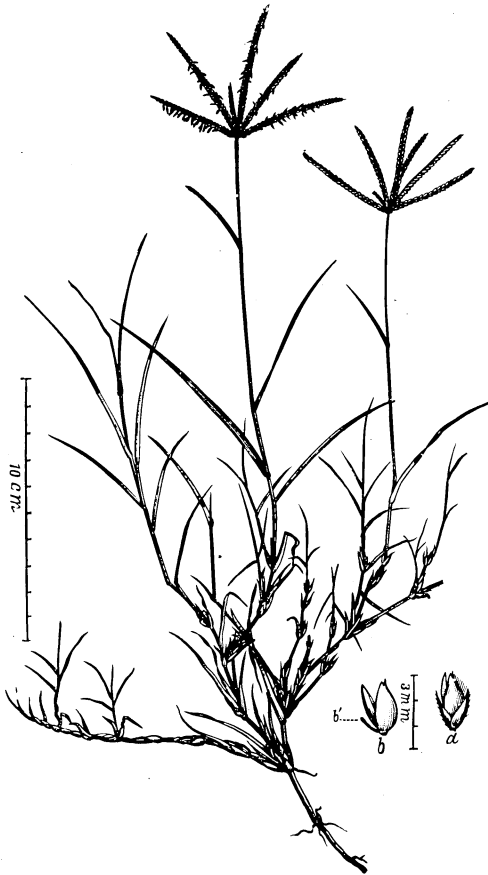


FIG. 3.—Bermuda grass (*Cynodon dactylon*).

mowing machine. The oat and vetch crop will make a heavy yield of very superior hay in May, and by October the Bermuda will fully occupy the ground and yield a heavy cutting. As the grass rarely matures seed in this country, the manure made from feeding it may be used without danger of spreading the grass where it is not wanted. Red clover is often sown where the land is first set with Bermuda, and although it does not usually make a heavy growth and becomes very scattering after the first two or three years, it very materially increases the yield of hay, which is superior in quality to either Bermuda or clover.

COWPEAS.

Of all annual plants used for hay, cowpeas are the most important, the most widely used, and the best. The cowpea is one of the few crops which will make rich fall grazing or yield abundant crops of good hay, and at the same time leave the soil in an improved chemical and mechanical condition for succeeding crops. Cowpeas make the best "catch crop" which can be grown for hay. They are the best crop which can be grown on land from which wheat, oats, or any early maturing crop has been gathered. There are many cultivated varieties of cowpeas, some maturing within sixty days from planting, while others continue to grow six months or more. If a heavy yield of hay is wanted the Clay, Whip-poor-will, and Unknown are the best varieties. If the crop is to be pastured the Black, Red Ripper, and Unknown are good; while for stock Black Crowder, Clay, and Unknown give heavy yields. When the crop is to be saved for hay it should be cut as soon as the first pods become yellow, and the planting should be timed so that this will occur during the dry weather of September and October. Although the hay is regarded as being somewhat difficult to cure, it is not so when cut at the proper stage of maturity and handled with care. Bulletin No. 40 of the Mississippi Experiment Station gives the following directions for saving the hay:

The mower is started in the morning as soon as the dew is off, and run until noon, or until as much has been cut as can be handled in the afternoon. As soon as the top of the cut vines is well wilted the field is run over with a tedder to turn the vines over and expose them more thoroughly to the air and sun. When the crop is very heavy the tedder is used a second time, though this is seldom necessary. Vines which have been cut in the morning and teddered in the afternoon are usually dry enough to put into small cocks the next afternoon, and if the weather promises to be favorable they are left in the cocks two or three days before being hauled to the barn.

If it should rain before the vines are put in cocks they are not touched until the surface is well dried off, and then they should be teddered as though freshly cut. The vines in cocks are not opened until well dried on the outside, and are then handled as little as is possible to secure a thorough airing. A light rain does very little damage to the hay, even after the curing has begun, if handled promptly and properly, and a heavy rain for a day or two may fall on freshly cut vines and do little or no damage. The essential point in making the hay is to do the work as rapidly as possible, and to avoid any handling of the vines when wet with either dew or rain. We find that it pays well to use a tedder for stirring up the freshly cut vines so as to admit the sun and air freely, though if a tedder can not be had the work can be done nearly as well, though more slowly, with a fork.

Cowpeas may be planted at any time from May until August, either broadcast or in drills. If the large growing varieties are planted in hills early in the season, 4 quarts will plant an acre, while if dwarf varieties are sown broadcast in August, 2 bushels should be used.

CRAB-GRASS.

Crab-grass is one of the volunteer grasses used largely for hay. It is a universal growth in fields from which oats, wheat, and other early crops have been harvested, and on rich soils will make a heavy yield of

excellent hay. In the northern section it often occupies the ground alone, but in the coast region it is usually mixed with beggar-weed or Mexican clover, especially the latter. On well fertilized, sandy soils near the coast, crab grass and clover often yield fully 2 tons per acre of hay. It needs unusual care in drying, but if cut before it is overripe, and properly cured, the hay is of good quality.

GERMAN MILLET.

German millet in nearly all of its various forms can be grown as a "catch crop" on ground which becomes vacant in June or July, as it will mature in from six to eight weeks from sowing and can be gathered in time for fall planting. The crop is exhausting to the soil, and should be sown only on good ground. Good crops can be made by alternating with hairy vetch, the latter seeming to provide the nitrogen needed by the millet. The vetch is mowed as soon as the seed begins to mature, about the first of June. The land is then plowed and sown with millet, which is cut in July. After that a moderate crop of crab-grass can be cut in October, and



FIG. 4.—Johnson grass (*Andropogon halepense*).

the vetch seed left in the soil will cover the ground for winter grazing or for an early crop of hay. This is one of the best hay rotations which can be used for a rich and fairly heavy soil.

JOHNSON GRASS.

Johnson grass (fig. 4) is a rich land grass. It is at the same time the most highly praised and the most severely condemned grass found in the South, and both opinions have ample foundation. It undoubtedly yields more and better hay than any other plant grown in this region. It will give from two to four cuttings yearly, and each cutting will make from 1 to 2 tons of hay. The hay, although coarse in appearance,

is sweet, tender, and nutritious. Horses and mules prefer it to any other. It is easy to secure a good stand of the grass, and when once established, a meadow is easily maintained as long as the planter may desire. The serious objections to its cultivation are the great difficulty of destroying it when the land is wanted for other purposes and the ease with which it spreads to fields where it is not wanted. In many localities it is the worst weed with which the cotton planter has to contend. It is more persistent on rich, heavy, and somewhat moist soils, and on such soils it is very seldom that it is ever completely eradicated. On dry and sandy soils it can be killed in one season by frequent and repeated plowings, but on heavy soils the fleshy roots will retain their vitality for months, even though frequently disturbed. Practically, it is never completely destroyed when once established on a favorable soil, and the farmer who plants it should do so only after careful consideration and with the expectation that it will remain on the land forever.

When cultivated for hay, the roots form such a dense mat in three or four years that the yield is much lessened. The ground should then be plowed and thoroughly harrowed during the winter or early spring, after which the grass will make a growth as vigorous as ever. The yield of hay is largely increased by sowing sweet clover with it, as the latter makes its first growth so early in the spring as to afford an additional cutting, while its deep biennial roots serve to keep the soil in a much better chemical and mechanical condition. Johnson grass does not bear grazing well, and when pastured it will soon almost wholly disappear, though it will still make sufficient growth to keep the roots alive and ready to start vigorously when the land is plowed again. When Johnson grass meadows begin to fail, many planters pasture them a year or two, and then plant in corn or cotton. Two or three cultivated crops can be grown on such land with very little trouble from the grass, but after a few crops have been made it will usually have regained such a hold that the ground needs only to be smoothed again to make it a profitable meadow. This grass seems specially adapted to the black prairie region and is now more or less abundant in all of that section. In other parts of the country it is more abundant on heavy alluvial soils than elsewhere, and is quite rare along the coast.

RED CLOVER.

Red clover grows well on rich lime soils which are in good condition, but needs to be managed somewhat differently from the method followed in the Northern States. Here, it should be sown in the fall, as soon as possible after the first of September. When sown at that time on well-prepared and finely pulverized soil, the land being rolled to compact the surface soil and prevent it from drying too deeply, the seed seldom fails to germinate and to make sufficient growth to become well established before cold weather. The crab-grass and weeds which come up with it are killed by the first heavy frost, and

when the warm days of spring come, the clover grows so rapidly as to keep down the weeds. On good soil it will make from 2 to 2½ tons of hay in May, with another lighter crop of hay or a good crop of seed in July. In favorable seasons it will make a third cutting, after which it usually begins to fail, and the ground should then be plowed for late corn. It is undoubtedly the best of the clover family for rich soils which are in good condition, but it is useless to sow it on barren fields or on rough and poorly prepared lands of any kind. It has not been satisfactory on either sandy or white lime lands.

SOILING AND FODDER CROPS.

The soiling crops available are not numerous, although there are many grasses and legumes which might be used. Alfalfa is used more than any other one plant, and on favorable soils its yield is heavy and continues for a long time. In central Mississippi, Alabama, and Georgia it can be cut once in six weeks from March until its growth is stopped by fall drouth, while further south its growth is more nearly continuous. Teosinte will outyield any other plant on the rich alluvial soils near the coast, but it is not ready for use before midsummer. Johnson grass is used extensively, while millo maize, Kafir corn, Jerusalem corn, and other sorghums yield repeated cuttings from August until killed by frost. In Florida, rice and Para grass are used largely for soiling. A considerable amount of forage, most of which is used on the farm, is made from oats, rice, corn fodder, and other annual crops. Corn fodder, made by stripping the leaves from the stalks as soon as the grain becomes hardened, is used very largely, and considerable amounts of it are sold in the country towns. The forage made in this way, when well cured, is of excellent quality, but so much work is necessary in gathering it that it can not be made profitably with hired labor. A large part of what is saved is gathered by laborers on shares, the share of the planter thus costing him nothing except the injury to the grain crop, which may amount to as much as 18 per cent of the grain when the fodder is stripped before the leaves have ceased their growth.¹

When oats are cut just after heading, they make hay of the finest quality, though if allowed to stand a few days too long but little of the straw will be eaten. As the crop is one which can be grown during the winter on ground from which corn or some other crop has been harvested, and is off the ground in time for planting in the spring, it is often the cheapest hay crop which can be grown.

Rice is grown for hay near the coast, and has about the same hay value as oats in the northern sections. Two successive hay crops are often grown on the same ground during the year, the yield of each crop being about the same as that of oats, averaging about one and a half tons per acre of each.

¹ Bulletin No. 30, Mississippi Agricultural Experiment Station.

As nearly the whole country is covered with timber very little wild hay is cut excepting in the prairie region of Louisiana. There several species of water-grasses are the common species of the wild lands, and make a very fair hay.

THE MORE IMPORTANT HAY AND PASTURE PLANTS.

In the following list only the more important of the native or cultivated hay and pasture plants are named. Many of these are rarely seen in other sections of the country; a few are regarded as worthless weeds in other localities; while others, common and valuable elsewhere, have not proved suited to the soil and climate of the Gulf States.

GRASSES.

Bermuda Grass (*Cynodon dactylon*) (fig. 3).—An extensively creeping and spreading perennial, stems slender; leaves numerous, spikes digitate, much like those of crab-grass, but shorter and more slender. Bermuda grass is to the South what Kentucky blue grass is to the North, and is the best hay and pasture grass for all soils which are not too wet. It is the most common grass in all parts of the Gulf States, and the vigor of its growth is a very good indication of the quality of the soil on which it is found. Its leaves and stems are so fine, and its creeping stems lie so close to the ground, that it makes an excellent lawn grass. Bermuda grass is never injured by protracted drought, and is unhurt by the most frequent grazings or cuttings. Its rootstocks are so strong and wiry that it is the best of soil-binders, and is used extensively for protecting levees and embankments. It is one of the best grasses for grazing, and may well be used in the Gulf States as the foundation for all permanent pastures. As a hay grass it is unexcelled. In favorable seasons it will give two cuttings, and on good soils its yield is from 2 to 4 tons of hay per acre.

Bermuda grass is usually propagated by transplanting the roots. This may be done at almost any time except during the coldest winter months, and the work is not more expensive than is the seeding of ground in the ordinary manner. Shave off sods an inch or two in thickness, cut them in pieces about an inch square, and drop on the ground about two feet apart each way, stepping on each one and crowding it into the soft ground as it is dropped. If it is necessary to do the work when the ground is too hard for this method, one man can make small holes with one stroke of the hoe, while another drops the sods and covers them with his foot. When the ground is in good condition, and the sods convenient, one man can plant an acre in a day.

If seed is used in propagating Bermuda grass the ground must be very carefully prepared, being harrowed as fine as possible. The seed should be sown in March, at the rate of about 6 pounds per acre and covered with a roller, though if sown just before a rain no other covering will be needed. As the seeds are small they must not be covered deeply or they fail to germinate. Being expensive and unreliable, seed is seldom used.

If the land is to be used for pasture only, the easiest means of securing a sod is to run shallow furrows from 2 to 4 feet apart into which sods are dropped every few feet and tramped into the soft soil. This method does very well for pastures, but leaves the ground too rough for mowing. So easily may Bermuda grass be propagated that good stands can be secured by scattering a dozen or more sods to the acre and then cultivating the land in corn or cotton two or three years, after which the grass will have become so well distributed that the field will need only to be plowed and harrowed once in three to five years. The yield is greatly increased, and the grass responds very quickly to an application of fertilizer, especially of stable manure.

When once established, it is somewhat difficult to eradicate, and this is occasionally an objection to its general cultivation. The best method of destroying it is to plow the ground immediately after the hay is cut, leaving it as rough as possible. Plow again in November and sow to oats, and when that crop is harvested plow again and sow thickly with cowpeas, which will smother the few plants which may have survived the oats and will leave the land in fine condition for any future crop. Ton for ton, Bermuda grass has a feeding value fully equal to that of the best timothy, and many horse-men prefer it to any other hay.



FIG. 5.—Big Blue-stem (*Andropogon provincialis*).

This is the most valuable species in the group and is used more largely for hay than any other. If cut when the flowering stems are not more than half grown it makes excellent hay, but, unfortunately, it reaches that stage at a time when most planters are crowded with work in the cotton fields, and hence is usually cut too late to make forage of the best quality. It has a large cluster of tender root-leaves which cure on the plant and remain there during the winter, forming an important addition to the winter forage. While there are other grasses which are better worth cultivating, the spontaneous growth of this is valuable.

BROOK-GRASS (*Andropogon glomeratus*).—Most abundant on marshes and low ground; stems large and coarse, 2 to 6 feet high, branching much toward the summit; leaves very long, rather wide, smooth, and glaucous, or hairy; spikes usually densely crowded at the summit of the stem.

Broom-sedges.—The Broom-sedges are among the characteristic grasses of the Gulf States, no less than forty species and varieties being found there. All have the same general character, yielding a great amount of grazing and hay of fair quality if cut early, but becoming dry, hard, and woody with the development of the flowering stems, and almost worthless in the late autumn. Some species are among the most common of the large grasses in the dry pine barrens, while others grow only in the damp savannahs, or act as sand binders on the island sand dunes. Under continued pasturing they give way to other grasses, and only two or three make their appearance again in fields which have been once cultivated. All are perennials, but are killed by the first plowing.

BIG BLUE-STEM (*Andropogon provincialis*) (fig. 5).—Usually in clumps, from large, coarse root-stocks; stems 3 to 6 feet in height, with several branches, more or less purple in color; leaves long and abundant, smooth or hairy; spikes 2 to 4, digitate at the summit of the branches; spikelets sparsely covered with rusty or yellowish hairs.

This is quite common and abundant on damp soils, and its long and abundant leaves give it considerable value for grazing, but its stems are too coarse and woody for hay.

BROOM-SEDGE (*Andropogon virginicus*).—Stems strictly erect from an almost woody base, flattened below and loosely branched above; lower leaves about 1 foot long, upper leaves shorter, smooth or hairy; panicle long and loose; spikes usually in pairs and partially inclosed by the sheaths; spikelets covered with white or yellowish hairs, and with awns nearly four times their length.

One of the most common species in old fields and on dry soils, being usually the first to make its appearance in old fields and often causing great annoyance in meadows. When young and tender it is grazed to some extent, but soon becomes tough and worthless. It is one of the most troublesome weeds of lawns and meadows, and has so little value for pastures that its growth should never be encouraged.

BUNCH-GRASS (*Andropogon tener*).—Stems very slender, with many widely spreading branches; leaves numerous, narrow, short, and smooth; spikes single, $1\frac{1}{2}$ to 3 inches long, slender; spikelets slightly hairy, half as long as the bent and twisted awn. The most slender and earliest flowering species in the group.

Very common in open, dry pine barrens, but the numerous stems are so wiry and the leaves so slender that it is not eaten well when other grasses are available.

JOHNSON GRASS (*Andropogon halepense*) (fig. 4).—Perennial from long, creeping rootstocks; stems single or in clumps, erect-branching, coarse, 3 to 6 feet; leaves numerous, long and broad, panicle open and spreading; seeds large and numerous. Much like a small sorghum in general appearance.

This grass has been in cultivation in this country since about 1830, and is now quite generally distributed through the Gulf States. It grows best on the rich and heavy lime soils of the black prairie region and along the creek bottoms of the yellow-loam region, and is rarely seen in the pine-woods region near the coast. In localities where it grows well it is at the same time one of the most valuable hay grasses and the most troublesome and pestiferous weed. As a pasture grass it has but little value, as it begins its growth late in the season and the tops are killed by the first heavy frost in autumn. Its large and fleshy rootstocks are near the surface, and are so injured by trampling that the grass soon almost wholly disappears from the fields, though there is always enough left to restock the land when it is again brought under the plow. Its greatest value is as a hay grass, and for that purpose it can not be excelled. On land which is suited to its growth it will give at least three cuttings annually, and make a total yield of from three to five tons per acre. The hay is coarse and not attractive in appearance, but stock of all kinds eat it greedily, seeming to prefer it to any other hay. Livestock who have used it state that it is the best hay they can find, but it is rarely fed in stables where there is a ready sale for the manure, for the seeds spread the grass wherever the manure may be used. But if the hay is cut, as it should be, before the heads appear, the manure from it can do no harm.

The objections to the cultivation of Johnson grass are the rapidity with which it spreads to fields where it is not wanted, and the great difficulty in eradicating it from fields where it has become established. It will soon almost disappear when fields are pastured, but the roots remain alive and will again take possession of the field as soon as it is plowed. Instances are known where fifteen and even twenty years of continuous pasturing have failed to produce any appreciable effect on the vitality of the roots. When there are only occasional small patches of it in a field they can be destroyed by hoeing and covering with salt to the depth of half an inch, but when it covers any considerable portion of a field the only practicable method of killing it is by weekly hoeings continued from early spring until late summer. On sandy soils it can be readily killed in this manner, but on heavy clay or black lands the work is more difficult, and will require a longer time. In any case, the field should be watched constantly for plants which are almost sure to make their

appearance from seeds washed in from adjoining fields or dropped by birds, cattle, or passing teams. It is so difficult to eradicate that it is rarely advisable to sow it on clean land, but if it is already established on the land it is often better to encourage it than to fight it, as a heavy crop of good hay is more profitable than is an ordinary crop of either corn or cotton.

LITTLE BLUE-STEM (*Andropogon scoparius*) (fig. 6).—Stems usually in clumps from strong roots, 2 to 4 feet high, flattened at the base, with numerous long branches, usually tinged with red or purple; lower leaves long and numerous, upper leaves

short, smooth, or hairy; spikes on long and slender peduncles, single, 1 to 2 inches long, with 5 to 10 joints.

Very common in dry fields and easily recognized by its purplish color and its habit of growing in bunches. Next to the Big Blue-stem this is the most abundant and valuable of the group, and furnishes a large part of the natural pasturage. It has a less abundant supply of leaves than the former, and the stems become hard and woody sooner, so that it is less valuable for hay.

SEASIDE BROOM-SEDGE (*Andropogon maritimus*).—Stems slender, coming from a crown which is often a foot or more below the surface of the sand, 1 to 2 feet tall, not branched; leaves 3 to 6 inches long, very numerous, and abruptly reflexed, sheaths overlapping; spikes single, or sometimes in pairs, 1 to 1½ inches long, partly inclosed by the sheath of the subtending leaf.

Found only on the sandy coast lands and islands, where it is a valuable species. As its roots are buried deep in the sand, it acts as an excellent sand binder, suffers but little from dry weather, and can not be pulled up by cattle. Stock appear to be very



FIG. 6.—Little Blue-stem (*Andropogon scoparius*).

fond of it, as it is usually eaten down closely before other broom-sedges or other grasses are touched.

Bur Grasses (*Cenchrus*).—Annuals, with spreading or decumbent and much-branched stems, 1 to 3 feet high; spikes single, with from 5 to 25 spiny burs.

There are several species of these grasses which are common on the sandy lands of the South, especially near the coast. While young the leaves are tender and are grazed closely, but after the seeds with their spine-like coverings are developed they are avoided. Sand bur (*C. tribuloides*) is the most common and a troublesome weedy species, while the cockspur (*C. echinatus*) is the largest and is often cut for hay.

Crowfoot Grass (*Dactyloctenium aegyptium*).—Annual; stems several and branching, erect or spreading, 1 to 2 feet high; leaves numerous, long, smooth; spikes 2 to 5, 1 to 2 inches long, digitate.

A common grass in cultivated grounds from central Alabama and Georgia southward, coming up as a volunteer crop after oats, melons, and other early field crops have

been harvested. It is usually more or less mixed with crab-grass, Mexican clover, and beggar-weed, and is highly valued as a hay plant. It comes up so late in the season that it is rarely troublesome as a weed. Most feeders prefer it to crab-grass, as it cures more easily. It appears to be more abundant in Georgia than elsewhere, and in many sections of that State nearly all the hay saved for home use is from this grass, grown in cornfields. Crowfoot hay is of good quality, though the yield is seldom more than one ton per acre when the grass is grown alone; it is often double that amount when mixed with Mexican clover or beggar-weed.

Feather-grass (*Leptochloa mucronata*).—Annual; stems clustered, erect, branched from near the base, 2 to 3 feet; leaves rather numerous, long, flat, somewhat roughened; panicles large and widely spreading, branches very slender and wiry; spikelet small. Common in rich, cultivated ground, and quite showy, but the leaves are so rough and the stems so hard and woody that stock refuse it when grazing, and it has almost no value. Usually regarded as a weed.

Goose-grass (*Eleusine indica*).—Annual; at first prostrate, but finally becoming erect; stems much flattened, smooth, 1 to 2 feet high; leaves numerous, long, smooth; spikes 3 to 6, digitate, 1 to 2 or 3 inches long.

A late species, which grows in cultivated ground in all parts of the South and is everywhere regarded as a troublesome weed. When sufficiently abundant to be cut for hay it makes a good crop, and as it makes its best growth late in the season it adds considerably to the fall grazing.

Japanese Wheat-grass (*Brachypodium japonicum*).—A short-lived perennial; stems several, spreading or upright, 2 to 3 feet tall; leaves numerous, long, nearly smooth, one-half to three-fourths of an inch wide at the base; spikes 6 to 10 inches long, rather diffuse; spikelets half an inch in length, with awns twice as long; whole plant usually more or less tinged with purple.

A winter-growing plant, first introduced into California from New Zealand, which does well under the same treatment as that required for Rescue grass, being at its best in March and April. It is valuable as a part of a mixture for newly prepared pasture lands. It has succeeded well in trial plots at all the Southern experiment stations, but has been less successful under ordinary field conditions.

Kentucky Blue grass (*Poa pratensis*).—This grass is not the uniform success in the Gulf States which it is farther north, though in some places it is of considerable value. On low ground where the soil is dark colored and contains an abundance of lime and on seepy hillsides it sometimes gives good late fall and winter grazing, but it is useless to sow it on dry clay hills, and it nowhere makes the smooth lawns and broad meadows which it does in more northern States.

Lizard-tail Grass (*Hackelochloa granularis*).—Annual; stems usually single, erect, much branched, 2 to 4 feet; leaves few at the base, very abundant on the stems, rather long and wide, rough; spikelets terminating the branches, 1 to 2 inches long, slender; seeds abundant.

An introduced species which is found occasionally in cultivated places, though rarely abundant. As it produces an unusual amount of seed, it makes a very rich hay, though the lower part of the stem is rather hard and dry. Regarded as valuable where it grows spontaneously, but not deemed worth cultivating.

Millet (*Chatochloa italica*).—When a crop of hay is wanted from land which has been occupied by some early crop, some variety of millet can often be used to advantage. It is a grass which requires rich land, and is exhausting to the soil; hence should not be followed by cotton or corn, though it may often be used to precede clover or the seeding of a field for permanent pasture. If cut early, before the seeds begin to harden, it makes excellent hay, but if the stems are allowed to mature they become so hard and woody that they are not eaten, and the seeds, if fed in any considerable quantity, are often injurious to horses and mules. The crop sometimes fails on account of a drought soon after sowing, but if rains follow, so as to germinate the seed and give the plants a fair start, they suffer little from later droughts. There are several varieties, differing principally in size, the form known

as German millet being the largest, growing from 3 to 5 feet high, and making the best yield on heavy soils; the common millet, growing from 2½ to 4 feet high, being the best variety for light soils; and Hungarian millet being the smallest and most quickly maturing sort of the three. Seed may be sown at almost any time during the summer, even as late as the first of August, at the rate of from 35 to 50 pounds per acre, and the early maturing sorts will be ready for cutting in about forty days from sowing.

Nimble Will (*Muhlenbergia diffusa*).—Perennial; stems numerous, much branched, spreading and ascending, very slender and wiry, 1 to 2 feet; leaves numerous, short, narrow, slightly roughened; panicle very slender, 3 to 6 inches; branches few, erect; rather densely flowered.

Very common in dry, shaded places, especially along fence rows, on the borders of woods, and about dwellings. The stems are so tough and wiry that the grass is difficult to mow, but it often forms a considerable addition to the winter grazing. A very good pasture grass, but hardly worth cultivating.

Orchard Grass (*Dactylis glomerata*) (fig. 7).—Perennial; stems in large clumps, erect, simple, 2 to 3 feet high; leaves very numerous, flat and broad, slightly roughened, often 18 inches in length.

This is one of the most widely grown of the cultivated grasses, and in the Gulf States is one of the best for winter pastures, as it makes a good growth on wet and heavy clay soils with ordinary field treatment. It commences its growth with the first warm days of February, and if not pastured is ready to cut for hay in April, and will then afford excellent grazing until checked by the summer drought. With the first autumn rains it starts a new growth of leaves, making rich fall pasturage, and remaining fresh and green throughout the winter. The hay made from it

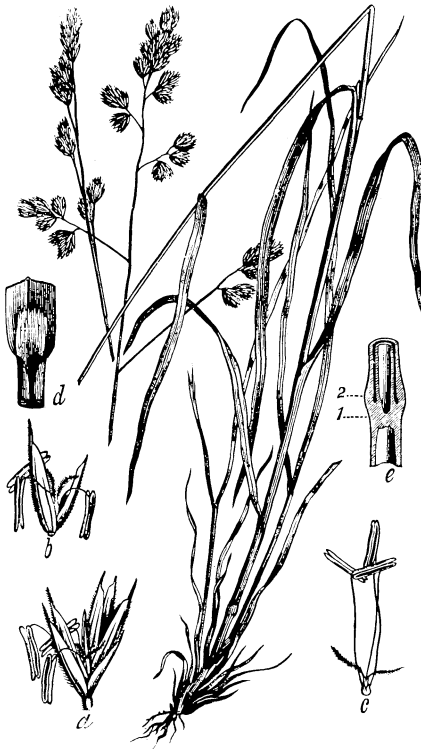


FIG. 7.—Orchard grass (*Dactylis glomerata*).

is of excellent quality, though its habit of growing in large clumps is against its use as a hay grass; but it bears grazing well and recovers quickly when cropped down. It does well when mixed with redtop, or alsike clover, and succeeds better than almost any other grass in woodland pastures. Sandy soils are not suited to its growth, and it can not be recommended for light and thin lands. Seed should be sown in August, or very early in the spring, at the rate of 30 to 40 pounds per acre.

Panic Grasses.—The genus *Panicum* contains more species than any other in the Gulf States, no less than 91, besides numerous varieties, having been found there, many of them being peculiar to that region. They grow in all situations, from swamps to dry hilltops. Some of the species are found only on wild lands, where they furnish more than half the grazing, while others rarely occur except on lands which have been in cultivation, and where they often make heavy yields of hay, which costs nothing but the harvesting. Although so abundant, there are few

species which are really worth cultivating. They are the natural grasses of the wild lands, and few of them flourish under the changed conditions brought about by cultivation. The following are among the more important species.

AUTUMN PANIC (*Panicum autumnale*).—Perennial; stems numerous, often in clumps of considerable size, spreading, 6 to 12 inches; leaves very numerous, short; panicle large and diffuse, about as long as the stem; branches very slender.

It grows on thin and dry upland soil, where it often forms a large part of the late summer and fall grazing. The var. *pubiflorum* is the more common form in central Alabama and Georgia, and stock graze it freely, but it is not worth cultivating.

BARNYARD GRASS (*Panicum crus-galli*).—Annual; stems single or in clumps, erect, sparingly branched, 3 to 6 feet high; leaves very long and abundant; panicles heavy and compact; spikelets awned or awnless.

This requires a rich and somewhat moist soil, its name, "barnyard" grass, indicating the locality which it prefers. It is a coarse and succulent grass, which is not easily cured into hay, but it is quite valuable for soiling and for the silo, as it yields heavily and produces an unusual amount of seed. In some sections of Mississippi and Florida it makes a good part of the volunteer growth which is used for hay. Dr. Phares, of Mississippi, says that "hundreds of acres are annually mowed, and farmers who have tested it thoroughly for many years prefer it to the best corn fodder." Several varieties of this, under the name of "Japanese barnyard millet," have been recently introduced and promise to be of great value. No reports of the value of these millets have been published from the Gulf States, but they have made such good yields in the north that they should be carefully tested there.

BITTER PANIC (*Panicum amarum*).—Perennial, from long, creeping, and branching rootstocks; stems erect or decumbent, not branched, 2 to 5 feet tall; leaves long and numerous; panicle erect, slender, often partly inclosed by the sheath of the upper leaf; whole plant very smooth and blue-glaucous.

This grass is confined to sandy beaches, and is one of the more prominent sorts on the coastal islands, where it furnishes grazing for hundreds of cattle. Its long and tough rootstocks and its ability to grow in the sandiest soils make it a valuable sand-binder.

COLORADO GRASS, OR TEXAS MILLET (*Panicum texanum*) (fig. 8).—Annual; stems few, branching or erect, often rooting at the base, 2 to 4 feet; leaves very numerous, large, nearly smooth; panicle 4 to 8 inches long, slender, branches closely flowered.

This has very much the same habit of growth as crab-grass, but is larger and coarser. It prefers low, damp soils, and in suitable locations will make two or



FIG. 8.—Colorado grass, or Texas millet (*Panicum texanum*).

three cuttings in a season, the hay being of very good quality. Like crab-grass, it reseeds the ground freely, and will often make a heavy volunteer crop after cultivated crops have been harvested, though it never becomes a troublesome weed. It is grown quite largely in some parts of Louisiana, and is regarded there as being the best of the annual grasses for a volunteer hay crop.

CRAB-GRASS (*Panicum sanguinale*).—Annual; though often perennial by its spreading stems, which root at each joint near the base; stems many and branching, spreading 2 to 4 feet long; leaves very numerous; 3 to 5 spikes, 3 to 5 inches long, digitate.

The most common grass in cultivated ground, making its principal growth late in summer after other crops have been harvested or laid by, and so furnishing a large amount of hay with no expense, excepting that of harvesting. Although not often on the market, crab-grass furnishes more forage for home use in the Gulf States than any other grass. When oats, melons, and other early crops have been harvested it will soon cover the ground, and by October will often make a yield of 2 tons per acre, while in the pine woods and coast region it will make nearly or quite as much on land from which corn has been harvested in August. Near the coast it is usually more or less mixed with Mexican clover, and on soils which are well fertilized the mixture will often give as much as 3 tons per acre of excellent hay. The objection to the hay is that, if allowed to become overripe before cutting, the seed shatters off badly and the stems become woody and tough. It is also rather difficult to cure, and must be allowed to dry several weeks before it can be baled with safety.

GUINEA GRASS (*Panicum maximum*).—Perennial by stout, creeping rootstocks; stems numerous, often in large clumps, coarse, 10 to 12 feet; leaves very numerous, large; panicle loose and spreading.

Probably an African species, but now well established in many sections of Florida and grown occasionally at other places near the Gulf coast, where it is valued highly for both hay and pasture. In regions suited to it, it grows very rapidly, and needs to be cut about once a month to prevent the stems from becoming too large and coarse. It makes good grazing and gives a constant and heavy yield for soiling. Seed ripens only in the extreme South and it is usually propagated by means of pieces of the rootstocks, which grow readily when transplanted. The stems are killed to the ground by the first heavy frost, and if the ground freezes slightly the roots are killed also. It has sometimes been confounded with Johnson grass, but is much less hardy and is much coarser and less valuable as a hay plant. Also, it is less troublesome as a weed.

MAIDEN CANE (*Panicum digitarioides*).—Perennial, from widely spreading rootstocks; stems erect, simple, smooth, 3 to 5 feet; leaves very abundant, broad, tender; panicle long, its branches long and slender.

Common in ditches and along the borders of marshes, where it affords a large amount of good grazing. It will not endure drought and is of little value for hay. Its strong creeping rootstocks make it desirable as a soil binder.

MUNRO GRASS (*Panicum agrostoides*).—Perennial; stems clustered, branched, erect, smooth, 1 to 2 feet; leaves very numerous, often a foot or more in length; panicles pyramidal, terminating each of the branches, much like those of redtop.

This is a wet-ground species which is very common on the borders of ponds or marshes and along the banks of streams, where it frequently makes a dense growth covering considerable areas. It makes good though rather coarse hay, of which two cuttings can be made in a season, but as it grows best on land too wet and uneven for mowing, its chief value is as a pasture grass. For late fall grazing it is one of the best of the family, and is well worth sowing on the wet places in pastures, but is worthless for dry soils.

MUTTON-CANE (*Panicum dichotomum*).—Perennial; stems clustered, spreading, much branched, very slender, 10 to 15 inches; leaves numerous, short, and narrow;

panicles loose and spreading, rather large, and on long peduncles in the spring, but small and almost sessile later in the season.

One of the most abundant native species, usually occurring on lands which have not been in cultivation. It is exceedingly variable in its habit of growth, assuming very different forms at different seasons, but making an almost continuous growth and forming the best part of the pastures on the pine-woods soils. During the winter its growth is confined to a tuft of very broad leaves at the surface of the ground, but in early spring stems are formed which continue to branch and produce seed until late in the fall. Sheep are especially fond of this grass, and many flocks live upon it almost wholly during the winter. Although so valuable in the native pastures, it is soon crowded out by other species when the land is pastured too closely or is brought into cultivation.

PARA GRASS (*Panicum molle*).—Perennial; stems decumbent and often 10 to 20 feet in length, with a few feet at the extreme end becoming erect; leaves very abundant, long and broad; panicle loose and spreading, 9 to 12 inches long.

This has been introduced from the West Indies or South America, and, where the climate is not too cold in winter, will produce an immense amount of forage. It does not mature seed in this country, but the roots live through the winter, the new growth being ready to cut by June 1, and it will furnish good cuttings every six weeks from that time until the end of the season, although it should not be cut after October 1, in order that it may have time to produce a crop of leaves to serve as a winter protection to the roots. It is of considerable value near the coast, but is too tender for regions subject to severe frosts.

SMOOTH CRAB-GRASS (*Panicum lineare*).—Perennial by creeping stems; stems prostrate, rooting at the joints; leaves very numerous, short, hairy, light colored; spikes digitate like those of crab-grass, but shorter and more slender.

Common on cultivated ground, especially on sandy soils, where it frequently forms a thick mat similar to carpet-grass. It remains green and continues to grow during the winter, and is grazed to some extent, but can not be regarded as valuable. When cattle are grazed on fields containing a large proportion of this grass they often become "sanded" from the accumulation of sand in the stomach, and losses from this cause are not uncommon.

SPROUTING PANIC (*Panicum proliferum*).—Annual; stems many and diffusely branched, succulent, smooth, 2 to 4 feet long; leaves very numerous, large and smooth; panicles many, diffusely branched.

This grows naturally on rich, moist soil by roadsides and ditches, but is often abundant in cultivated fields with crab-grass. It is rather difficult to cure for hay, but cattle and mules are very fond of its sweet and juicy stems, and as it makes its best growth late in the season after many of the early grasses have been killed by drought it is of considerable value, although hardly worth special cultivation.

Poverty Grasses (*Aristida*).—The species in this group are easily recognized by the 3-parted beard at the upper end of each spikelet. They are widely distributed, growing in every variety of soil, but are not usually regarded as valuable anywhere. They are among the first grasses to take possession of worn-out and abandoned fields, roadsides, and other barren spots, and their presence is usually regarded as an indication of a thin and unproductive soil. A few of the species are common on good soils, and in the dry pine barrens they form no small part of the grazing for spring and early summer, but are never grazed after the culms begin to grow. *A. stricta* is one of the numerous perennial "wire grasses" of the pine woods, growing in clumps 2 to 3 feet tall. This gives more grazing than any other of the group, but is a pest to sheep, as the sharp, bearded "seeds" catch in the wool and often work their way into the skin. *A. palustris* is a common swamp species, growing 3 to 4 feet tall, but is coarse and harsh, even when young. *A. gracilis* is a small and slender species, seldom more than a foot in height, which is occasionally found in cultivated lands and is one of the first to appear when cultivation

has ceased. As a whole, the *Aristidas* are more nearly worthless in the South than any other group of grasses, though none of them become troublesome weeds.

Purple-Top (*Anthranantia rufa*).—Perennial, from a stout rootstock; stems usually single, 2 to 3 feet tall; root leaves abundant, long, narrow and smooth, stem leaves few and short; panicle compact, 3 to 5 inches long; spikelets very hairy and usually bright purple.

Common on the pine barrens of the coast region, although nowhere making a dense growth. It is eaten well, even when quite mature, and it is an important element in the natural pasture. There is another species (*A. villosa*) which is found on damp

soils. The root leaves are short and few, lying flat on the ground, so that it has little grazing value.

Redtop (*Agrostis alba*).—This grass is found in nearly all parts of the United States and presents many forms by some regarded as distinct species. Its greatest value in the Gulf States is as a pasture plant for damp soils. For this purpose the form having long, underground rootstocks (*Agrostis stolonifera*) is the best, as it is least injured by trampling. It does best on a soil which is rich and moist, but will grow fairly well on a dry clay soil, although not on dry sand. It bears continued overflows without injury, even when covered by water two or three weeks, and on most soils is more persistent and productive than Kentucky blue grass. It is one of the best grasses for winter and early spring grazing, and should be used on the damp places in every pasture. It makes a moderate yield of fair hay and is especially valuable for mixing with orchard grass, alsike clover, and other moisture-loving sorts. It makes but little show the first season after seeding, but becomes stronger and more dense with age, and holds its place well against other grasses and weeds. In seeding, one bushel per acre should be used, and to that it is



FIG. 9.—Rescue grass (*Bromus unioloides*).

well to add half a bushel of perennial rye-grass, which will occupy the ground the first year, but will disappear as the redtop becomes stronger.

Rescue Grass (*Bromus unioloides*) (fig. 9).—Annual or perennial; stems single or in small tufts, erect, not branched, 2 to 4 feet high; leaves numerous, long, tender; panicle large, loose, and spreading, spikelets drooping.

This is apparently a native of the southwestern part of the United States, and was one of the first of the native grasses to be brought into cultivation. It is known as Australian oats, Australian brome, Arctic grass, and Schrader's brome. Although usually an annual, repeated cuttings or persistent grazing will prevent seed-bearing, and so enable the plant to live several years. It grows best on a rich, loamy soil, and

in most localities should be treated as an annual, as it is soon crowded out by other grasses on land which has not recently been plowed. It seeds freely, and yields volunteer crops as far north as the District of Columbia. When sown on suitable soil in August or September it begins its growth with the first autumn rains, and in a favorable season will give good grazing in December, while in a dry and unfavorable season it may be worth but little before February or March. When at its best it will often give two good cuttings for hay. Should it be desired to grow it continuously on the same field, the land ought to be plowed after the seed has matured, and during the summer it may be used to grow a crop of cowpeas or of crab-grass, which should be cut in September to permit the rescue grass to secure an early growth. Seed should be sown in August or September at the rate of from 30 to 40 pounds per acre.

Rough Bent (*Agrostis scabra*).—An annual with slender, smooth, clustered stems and open panicles, 1 to 2 feet long, with widely spreading, capillary branches. Found everywhere, but more common on rather dry and hard clay soil. It makes its growth early in the spring, and so adds some forage to the early pastures, but it is not eaten after it comes into bloom in May, and soon disappears.

Rye-grasses (*Lolium italicum* and *L. perenne*).—Short-lived perennials; stems clustered, often decumbent at the base, becoming erect, 2 to 3 feet tall; leaves very numerous, dark green, rich and tender, 4 to 8 inches long; spikes long and slender, often drooping.

These are among the oldest cultivated grasses, and are probably grown more widely than any others in Europe. They have been used largely in the Northern States, where they are often satisfactory, but in the South they have not done well except in a few especially favorable locations. They succeed best on a rich, moist, sandy soil containing a fair amount of lime, and on such soils are fairly permanent, but on dry, thin soils and heavy clays they soon disappear. They will cover the ground sooner and make a better sward in a few weeks after planting than will most other grasses, and so are valuable where quick results are wanted and for covering the ground while other and more permanent sorts like redbtop or orchard grass are becoming established. When sown alone on rich soils their growth is so rank that the ground is soon covered with a dense mat of long leaves, which make the best of grazing or hay, but if allowed to become too dense will die and decay after heavy rains. While excellent for mixing with other grasses for both pastures and meadows, they can not be recommended for sowing alone. The more common varieties are the Italian, Pacey's, and the perennial rye-grasses. The perennial or English rye-grass is the longer lived and so the best for permanent pastures. The Italian rye-grass makes a ranker growth and covers the ground more quickly. Seed may be sown in either fall or spring, and from 2 to 3 bushels per acre are required when sown alone or 1 bushel when sown with other grasses.

Salt-grass (*Distichlis spicata*).—Perennial, from long, creeping rootstocks; stems slender, erect, wiry, branching; leaves short, smooth; spikes of two forms, staminate and pistillate, the first rather slender, while the latter are shorter and thicker.

Growing on salt marshes everywhere, and of little value except as a sand or soil binder. When not too old and tough it is eaten by horses and mules, where other grasses are not to be had, but it makes poor grazing and is worthless for hay.

Side-oats Grama (*Bouteloua curtipendula*) (fig. 10).—Perennial; stems single or few together, simple, erect, 2 to 3 feet tall; leaves 6 to 12 inches long, rough; spikes forming a long raceme and usually reflexed, about half an inch long, purple.

This is the southeastern representative of the large group of grama or mesquite grasses which are so numerous in the pastures of the Southwest. Like them, it grows on dry soil, is rarely injured by drought, and is so deeply rooted that it is not injured by grazing. It is found from Mississippi to Georgia, though rarely abundant, and its growth should be encouraged. The seeds are easily gathered and grow readily on lawns already set with other grasses. There is another *Bouteloua* found in Florida, but neither species is so abundant as to be of much importance.

Small Cane (*Arundinaria tecta*).—Perennial; stems woody, branching above, from a few inches to many feet in height; leaves numerous, lanceolate, somewhat rough and hairy, remaining green until the second season. Seeds as large as grains of barley, in panicles resembling those of rescue grass; maturing in February and March. There is also a second species, *A. macrosperma*, which sometimes reaches a height of 40 feet. These canes are indigenous on alluvial lands and along streams throughout the whole Gulf region, reaching their greatest perfection on the low lands near the Mississippi River and in Florida, where they often form extensive “canabrakes” whose growth is so dense as to be almost impenetrable. It is too woody to be cut for hay, but where it grows in sufficient abundance it makes valu-

able winter grazing, and thousands of cattle are wintered without any other feed. The seeds are produced on slender canes from 1 to 3 feet tall, but only at long intervals, and the whole plant dies soon after the seed is matured. Usually all the plants in a locality, which may be from a few rods to many acres in extent, produce seed the same season. Cattle fatten rapidly on the large, starchy seeds, and the dying plants are replaced by a new growth the following season. Attempts to cultivate the cane, either by seeding or by transplanting roots, have not been very successful, and as it grows only on the richest soil its area is rapidly decreasing with the opening of new fields.

Smooth Brome (*Bromus inermis*).—Perennial, from extensively creeping rootstocks. Stems unbranched, erect, 2 to 3 feet high; leaves abundant, long, smooth; panicles spreading when in flower, but becoming close, with the branches erect as it approaches maturity.

Although this grass has been popular in European pastures for more than a hundred years it does not appear to have attracted attention in the United States until about fifteen years ago, when it was highly recommended by the California experiment station. It was soon tested by many of the stations in other parts



FIG. 10.—Side-oats Grama (*Bouteloua curtipendula*).

of the country, and nearly all of the earlier reports published were strongly in its favor. At all of the stations in the Gulf States it succeeded finely, and was thought to be of great value for winter pastures. It grows well in cool weather and bears drought. Cattle graze it with relish. In the South it is more valuable for pasture than for hay, and does better on dry than on wet soils. Although its growth on the trial plots was all that could be desired, its growth in the field has often been disappointing, and it is not gaining in general favor excepting in the Northwest. After eight years of experience with this grass on a great variety of soils it appears to be of doubtful value in the Gulf States. It has here some value for winter grazing on dry and loose soils, but its place can be better filled with other species.

Southern Canary-grass (*Phalaris caroliniana*).—Perennial; stems single or in small clumps, slender, erect, not branched, 3 to 4 feet; leaves abundant, 10 to 15 inches long; spikes erect, 3 to 6 inches long, much like those of timothy. This grass has so much the appearance of timothy that it is often called "southern timothy," though it is closely related to the true canary-grass. It is widely distributed on damp soils along the coast from Louisiana to Florida, and is valued highly for winter and early spring grazing. Attempts to cultivate it for hay have not resulted successfully, as it fails to cover the ground well. Its chief value is as a pasture grass, and for that purpose it is well worth using as a part of the mixture for wet lands.

Smut Grass (*Sporobolus indicus*).—Perennial, often in large clumps; stems slender, erect, seldom branching, soon becoming woody and tough, 2 to 3 feet tall; leaves abundant, long, and smooth; spike long and slender, usually blackened by a smut (*Helminthosporium ravenellii*).

Very common everywhere in door yards and other places where the soil is rich and has been well trampled. It is worthless as a hay grass, but as the leaves remain green through the winter, it is of considerable value for grazing, especially for horses.

St. Augustine Grass (*Stenotaphrum dimidiatum*).—Perennial by its widely creeping, flattened stems, which are much branched, and often reach a length of several feet; fruiting branches erect, 4 to 8 inches high; leaves numerous, short, rather broad and obtuse.

Common, sandy soils near the coast. A valuable sand-binder. It is frequently used as a lawn grass and makes a fair turf, but its color is too light to make it as attractive as Bermuda, and the stems and leaves are coarser.

Tall Fescue (*Festuca elatior*).—Perennial; stems usually in small clumps, rather stout, smooth, erect, 2 to 3 feet; leaves abundant, long and slender, dark green; panicle 6 to 9 inches long, loose and spreading.

One of the popular introduced species, sometimes known as tall meadow fescue, English blue grass, Randall grass, and by other names. It succeeds best on rather moist, rich alluvial or clay soils such as are commonly found along creek bottoms. It makes good hay, and as it remains fresh and green longer than most others, it is quite valuable for permanent winter pastures. When grown for hay it should always be mixed with other grasses on account of its habit of forming large clumps when grown alone. Redtop and alsike clover will grow well on the same kinds of soil, and the three make an excellent mixture for either meadows or permanent pastures.

Tall Oat-grass (*Arrhenatherum elatius*) (fig. 11).—Perennial; stems 2 to 4 feet tall, simple; leaves not numerous; panicle similar to that of the cultivated oat, but smaller, and the spikelets only about one-third of an inch in length.



FIG. 11.—Tall Oat-grass (*Arrhenatherum elatius*).

Introduced from Europe, where it is one of the most valuable species for both hay and pasture. It is so highly prized in Europe that it has been planted repeatedly in all parts of the United States, and with widely varying results. In most cases it has been more successful in the North than in the South. Professor Scribner recommends it for Tennessee, and it has also been highly recommended for northern Alabama, Georgia, and North Carolina, but that seems to be about the southern limit of profitable cultivation. Farther south it is so weakened by the long summers that after a few years it is crowded out by other species. It grows best on a light and rather dry loam; it makes its best growth early in the season, and is easily cured for hay. It does not cover the ground well when sown alone, and for either hay or pasture should be mixed with orchard grass, perennial rye, red clover, or some other plant which will occupy the ground more fully.

Texas Blue grass (*Poa arachnifera*).—Perennial from underground rootstocks; stems scattered, erect, rather stout, seldom branched, smooth, 18 to 24 inches; leaves abundant, long, thick, smooth; panicle loose; spikelets covered with white woolly hairs.

This is emphatically a winter-growing species. In favorable location it begins its growth in October, and from November to May furnishes an abundance of luxuriant pasturage. It matures its seed in April and from the first of June until October makes but little growth. It is difficult to propagate by seed, but can be increased rapidly by means of the suckers which are produced in great numbers. A rich, loamy soil seems best suited to its growth, but in many places where the soil has appeared to be favorable its growth has been disappointing. Its only value is for winter pastures. It has given good results at the experiment stations of Mississippi, Alabama, Georgia, and Florida, but owing to the difficulty of propagation it has been very slow in coming into general cultivation.

Teosinte (*Euchlana luxurians*) (fig. 12).—Annual; stems very numerous, sometimes 60 to 70 from a single seed, 6 to 12 feet tall. The stalks, leaves, and spindle resemble Indian corn.

This is the plant of which Prof. Asa Gray said, "Possibly affording an opportunity for one to make millions of blades of grass grow where none of any account grew before." At the experiment stations of Louisiana, Mississippi, Georgia, and Florida it has given the heaviest yields of any of the forage crops grown, Georgia reporting 38,000 pounds of green forage per acre, Mississippi 44,000, and Louisiana the enormous amount of over 50 tons. It needs a long season of hot weather, a rich soil, and abundant moisture in order to succeed well, and it is useless to plant it where all these conditions can not be had. It is a remarkably vigorous grower, reaching 10 to 12 feet in height, with an unusually abundant supply of leaves and tender stems, which continue to grow until killed by frosts. If cut when it reaches 4 or 5 feet in height it makes excellent fodder, and will produce a second crop fully as large as the first. If left to grow until September or October it furnishes excellent material for the silo, in greater amount per acre than either corn or sorghum, and there are few plants which are its equal for soiling purposes. Its leaves are similar to those of sorghum, but much longer, and the stalks contain from 8 to 10 per cent of sugar. Its value for feeding and soiling is apparent from the fact that the entire crop of 50 tons per acre grown at the Louisiana station was sold to local dairymen at the rate of \$2 per ton while standing in the field. Its season of growth is so long that it seldom matures seed north of latitude 30°, but it has ripened well at the Louisiana and Florida stations. The seed, 4 to 5 pounds per acre, should be planted in hills 4 to 5 feet apart each way, about cotton-planting time, and the crop cultivated like corn. The greater distance should be given on the richer soils.

Timothy (*Phleum pratense*).—Rarely successful in any part of the Gulf States. It makes one good cutting in the spring after it is sown, but the long summer weakens the bulb-like roots so that but few plants survive until the next year.

Toothache-grass (*Campulossus aromaticus*).—Perennial from stout rootstocks; stems single or clustered, erect, unbranched; leaves long, narrow, smooth; spikes



FIG. 12.—Teosinte (*Euchlæna luxurians*): *a*, one of the “ears” inclosed by the “husk”; *b*, the same with a portion of the husk removed, showing the grains; *c* and *d*, views of the grain.

terminal and at right angles to the stem, becoming curved when old; spikelets with awns one-fourth of an inch long.

Common on wet pine barrens, and one of the most conspicuous of the native grasses. The rootstocks, when mature, have a pungent, aromatic taste, and chewing them is said to be a remedy for toothache. The whole plant is more or less aromatic, and is rarely eaten by stock.

Velvet-grass (*Holcus lanatus*).—Perennial; often in large clumps; stems erect, not branched, 1 to 2 feet high; leaves very numerous, long, and wide; panicle 2 to 3 inches long, erect, compact, often tinged with purple; whole plant clothed with soft white hairs, which give it a very striking appearance.

This is one of the European grasses which has been highly recommended and extensively planted, but has rarely been successful in the Gulf States. It sometimes remains fairly permanent on thin soils where it is not crowded by other sorts, but is never eaten well by stock. On richer and moister soil it is often seriously affected by one of the same rusts which attacks oats. It should be sown only when in mixtures and on thin soils.

Water-grasses (*Paspalum*s).—The *Paspalum*s rank next to the panic grasses in importance and in number of species in the native pastures, 36 being found in the South. Like the panic grasses, very few are of much value for hay. The group furnishes several of the best pasture grasses, however, and some of these are well worth cultivating. Most of the species prefer a moist soil, and though they are often found on soils which are quite sandy, they are rare on dry clay hills. Most of them are perennial, and several bear cold so well that they are of considerable importance in winter pastures.

CARPET-GRASS (*Paspalum compressum*).—Perennial; stems erect or decumbent, extensively creeping and rooting at the joints, upright stems 6 to 18 inches; leaves very numerous, short, obtuse, smooth; peduncles long and slender, terminated by 2 to 4 very slender spikes 1 to 2 inches long, similar to those of crab-grass.

This is apparently indigenous along the coast, and is slowly spreading northward, being now somewhat common in central Mississippi and Alabama. It is undoubtedly the best pasture grass we have for sandy soils, and it will bear more hard trampling and close grazing than will any other species. On heavy soils it is often crowded out by Bermuda and other species, but on light soils of even moderate fertility it will soon cover the ground, to the exclusion of all others. It is a grass which soon comes in when sandy soils are pastured closely and will choke out the broom-sedge and other less desirable sorts. It is easily destroyed by plowing and never becomes a weed. It rarely grows large enough to be cut for hay, though on the prairies of southwestern Louisiana, where it is known as "*petit gazon*" it reaches a height of 2 feet or more and covers a large part of the native meadows. The seed is rarely found in the market, but the plant is easily propagated by mowing when the seed is ripe, and scattering the hay over the field where the grass is wanted. Even if but few plants should appear the first year, the seeds will soon be spread by stock so as to cover the entire field. It bears heavy frost without injury, and so affords considerable grazing during the entire winter. It is often used as a lawn grass on soils too light and sandy for Bermuda, and is excellent for that purpose, though its rather light color makes it less attractive than a grass having a richer green.

HONEY DEW (*Paspalum plicatulum*).—Perennial, though often growing as an annual; stems, many from a single root, much branched, spreading or erect, smooth, 2 to 3 feet; leaves numerous, rather long, nearly smooth; spikes 4 to 10, spreading, 2 to 3 inches long, hairy on the axils; spikelets usually in 4 rows; stems and leaves usually purple in color.

Common on moist and heavy soils, though often found in dry places. In habit of growth it is much like crab-grass, coming up in cultivated fields after other crops have been laid by, and making a good yield of hay, which is sweet and well liked by stock, but is slow in curing. This is one of the prominent species in the native meadows of the Louisiana prairies, and is one of the more abundant sorts eastward

to Florida, often covering entire fields from which oats, melons, or other early crops have been harvested.

KNOT-GRASS (*Paspalum distichum*).—Perennial; stems creeping extensively and rooting at the joints, with ascending or erect branches 6 to 12 inches tall; leaves very numerous, short, small; spikes usually 2, divergent, 1 to 2 inches long.

A grass having much the same habit of growth as carpet-grass and Bermuda, but confined to very moist soils on the borders of ponds or streams and similar locations. It is very common in ditch bottoms, where it is sometimes quite troublesome, as it catches the sediment from the running water and soon fills the ditch. Both stems

and leaves are quite succulent and tender, and are grazed closely during the late summer, but as it is killed down by moderate frosts it is of but little value for winter pastures.

LARGE WATER-GRASS (*Paspalum dilatatum*) (fig. 13).—Perennial; stems in clumps, erect, seldom branched, smooth, 3 to 4 feet; leaves very numerous near the ground, fewer on the stems, a foot or more in length; spikes 4 to 7, erect or spreading, 2 to 4 inches long, with a small cluster of white hairs on the axils; spikelets pubescent.

A rather coarse grass, which grows best on rich and rather damp soils. It spreads slowly from the roots, but seeds freely, and when once started will soon cover a field where the soil is suited to its growth. The stems are rather coarse for hay unless cut early, but it produces a very large amount of long and broad leaves, which remain fresh and green during the entire winter. It withstands the longest droughts without injury, bears grazing well, starts its new growth early in the spring, and is one of the best pasture grasses. Its habit of growing in clumps is an objection to its use for



FIG. 13.—Large Water-grass (*Paspalum dilatatum*).

hay, but it is an excellent variety for mixing with redtop, as it grows best on the same character of soil and largely increases the yield.

Wild Barley (*Hordeum nodosum*).—Annual; stems single or in small clumps, geniculate at the base and becoming erect, smooth, 9 to 12 inches high; leaves abundant, short and narrow; spikes slender, 2 to 3 inches long; spikelets bearded, soon falling apart.

This is often abundant in early spring on hard clay soils which are heavily tramped. It gives a little good grazing in March, but is not eaten after the heads begin to show, and by May the stems are dead and dry. Little more than a worthless weed.

Wild Rye (*Elymus*).—There are three species of wild rye which are rather com-

mon throughout the South. All grow in stools similar to those of wheat or oats, with erect stems 3 to 5 feet high; leaves and spikes like those of rye.

Rather coarse grasses, common along fence rows and creek bottoms, where the soil is rich and somewhat damp. The Canadian wild rye (*E. canadensis*) is the tallest and coarsest of the three, and has but little value. Dennett-grass (*E. striatus*) is more valuable, but not as good as the Terrell-grass (*E. virginicus*). The latter grows in woodland pastures and furnishes a large amount of grazing through the winter and early spring.

Woodland Bunch-grass (*Eragrostis glomerata*).—Perennial; often in large clumps; stems slender, erect, smooth, 1 to 2 feet; leaves numerous, slender, rather short; panicle sometimes a foot in length, slender and compact, producing a very large amount of seed.

This is an excellent summer grass for moist woodland pastures, often growing on the edges of marshes and other damp locations where but few good grasses are found. Cattle appear to be very fond of it, and it is doubtless worth planting in pastures. This is almost the only species of *Eragrostis* which is of value found in the Gulf States.

MISCELLANEOUS FORAGE CROPS.

Alfalfa (*Medicago sativa*) (fig. 2).—One of the most common cultivated forage plants of the West, and rapidly coming into favor in the South. It is a very deep-rooted plant which bears drought well, but the roots can not endure stagnant water or sour soil, so that it must always be grown on lands which have good drainage. It is a very prolific hay plant, as it will give from two to four, or more, cuttings annually, each cutting making from 1 to 2 tons of hay. It should be cut as soon as it comes into bloom, or before the stems become hard and woody. The hay should be handled as little as possible, as the leaves drop off very easily, and when badly handled the hay is little more than coarse stems. Well-made hay has about the same value as that from red clover. As a pasture plant it is good for horses, mules, and sheep, but not safe for cattle, as it occasionally causes bloating. It is one of the best plants for a summer hog pasture, and also affords considerable winter grazing. The greatest difficulty in growing it is in securing a good stand. The land on which it is to be sown should be put in the best possible condition, and seeded in September at the rate of 15 to 20 pounds per acre, though good results are often secured with 10 pounds of seed. The ground should be rolled after sowing. On most lands crab-grass and weeds will come up thickly with the alfalfa, but will be killed by the first heavy frosts, and by spring the alfalfa will be strong enough to smother other growths.

Seeding may also be done in the spring, but if the field is not watched many of the alfalfa plants will be smothered by grass and weeds. If weeds threaten to injure the stand, the field should be mowed, setting the mower as high as possible to avoid cutting the young alfalfa, after which it will usually be strong enough to protect itself. When a stand is once secured it is permanent. Professor Newman, director of the South Carolina experiment station, states that he has known a field of alfalfa to give good crops fourteen years in succession in Alabama, and twenty-five years in Georgia. It springs up quickly after each cutting, and Dr. Taliaferro, of Orange County, Fla., states that he has cut five crops within twelve months from seeding, while Dr. Stubbs, of the Louisiana station, reports fourteen cuttings in eighteen months from seeding. Farther north it is less prolific, but is everywhere one of the best soiling crops.

Alsike Clover (*Trifolium hybridum*).—Perennial; intermediate between the white and red clovers in habit and appearance.

Alsike is the best of the clovers for wet grounds, but is of no value on dry soils. On the borders of marshes, seepy hillsides, and places too wet for other clovers this makes its best growth. It seldom grows sufficiently large to make a good yield of hay, but is an excellent pasture plant, and should always be sown with redtop on

the damp places in a permanent pasture. Sow 6 pounds of seed per acre in September or March.

Artichoke (*Helianthus tuberosus*).—Perennial, by underground tubers; stems erect, 5 to 8 feet; leaves and flowers much like those of the ordinary sunflower, but smaller.

One of the best and most profitable crops for winter hog pastures. The tubers may be cut in small pieces for planting, as is done with Irish potatoes, and about the same amount of "seed" per acre is required. They are planted in the same manner and require the same cultivation as the Irish potato. The tubers make very little growth before October, and do not become thoroughly matured before December. The yield is larger than that of any other root crop, being ordinarily from 400 to 600 bushels per acre, while double those yields are secured under specially good conditions.

When the crop is fully matured a few rows should be plowed out to secure "seed" for spring planting, and this should be buried like potatoes. When the field is turned over to the hogs enough of the tubers will be left in the ground to restock the field, but as the hogs will leave the ground very rough and uneven, and the plants will be so irregular that they can not be cultivated, it is much better to plow the entire field in the spring and replant in regular rows. When it is desired to clear a field in which artichokes have been grown it can be accomplished by a single plowing in June or July, after the new growth has exhausted the old tubers and before the new crop has formed.

Birdfoot Clover. Yellow Trefoil (*Lotus corniculatus*).—Perennial; stems branching, slender, nearly prostrate, 3 to 12 inches; leaves very numerous, small; flowers yellow, in small heads.

This grows well on hard and sterile soil, roots deeply, bears drought well, and is of considerable value as a pasture plant. It begins its growth very early in the spring, but is little esteemed after



FIG. 14.—Bur-clover (*Medicago maculata*).

the beginning of summer. It is well worth sowing in dry pastures.

Buffalo Clover (*Trifolium reflexum*).—Annual or biennial; stems in large clumps, erect, downy, 9 to 12 inches; leaflets roundish or obcordate; flowers nearly white; calyx reflexed when mature.

Very similar to red clover in appearance, excepting in size and color of flowers. It is widely distributed, being more common along fence rows and ditch banks than elsewhere, and is nowhere abundant. It is a good grazing and hay plant, but grows so poorly in open fields that it is not profitable for cultivation.

Bur-clover (*Medicago maculata* and *M. denticulata* (fig. 14)).—Annual; stems branching, decumbent, 1 to 3 feet; leaves very numerous, large, tri-foliolate, each leaflet with a dark brown spot in the middle; flowers small, yellow, in small heads on long peduncles; seeds in a small bur.

Extensively introduced, and a valuable pasture plant for early grazing. Eaten well by cattle and sheep, and occasionally by horses and mules; of little value for hay. Seed should be sown in October, on rich loamy soil, and the plants will make good grazing by February or March. The seed matures in April and May, after

which the ground may be plowed and cultivated in other crops during the summer. The clover seed will remain in the ground, and if the field is cleared of its summer crop by October no reseeding will be required. An excellent plant to mix with Bermuda on a calf pasture.

Bush Mallow (*Sida Elliottii*).—Perennial; stems slender, erect, 2 to 3 feet; branches long and straight; leaves very narrow; flowers yellow, 1 inch wide.

Rather common in dry, open woods, and eaten well by cattle, probably for its mucilaginous seeds, even late in the season after the stems become dry and hard. Not worth cultivating.

Butterfly Pea (*Clitoria mariana*).—Perennial; stems erect or twining, 2 to 4 feet; leaflets 3, ovate-oblong; flowers pale blue, 2 inches in diameter; legumes $1\frac{1}{2}$ to 2 inches long.

Common on dry, woodland soils, and yields nutritious grazing, but is too scattering to be of much value.

Canada Field Pea (*Pisum arvense*) (fig. 15).—An annual, much like the common garden pea. It has been planted at many places in the Gulf States, but has never proved valuable. When sown in the fall its growth is not equal to that of the vetches, while if sown in spring it suffers severely from mildew.

Carolina Clover (*Trifolium carolinianum*).—Perennial; stems tufted, prostrate, 6 to 10 inches; leaflets small, obcordate; flowers white, tinged with purple; calyx reflexed when mature. Common on dry clay soils, making its growth early in the spring and soon disappearing; valuable only because it gives a little early grazing on soils too poor for most other plants.

Cassava (*Manihot aipi*) (fig. 16).—Perennial; stems erect; branching, 4 to 6 feet; leaves large, palmately compound; roots 3 to 5 feet long, 1 to 2 inches in diameter, and very starchy. A native of the tropics, but recently introduced in Louisiana and Florida. On fertile soil it is said to yield as much as 10 tons of roots per acre, and the roots are worth fully as much as potatoes for feeding. The plant is propagated by planting short cuttings of the stems, and requires only ordinary cultivation. As the roots decay quickly after being taken out of the ground, they should be dug only as wanted for use.

Chinese Yam (*Dioscorea batatas*).—A perennial twining vine, often reaching a length of 20 feet; leaves heart-shaped; flowers small, white, in rather dense clusters.

The roots are quite large, club-shaped, often reaching 3 feet in length with a diameter of 3 inches at the lower end. They are starchy and mucilaginous, and make a food fully as rich as sweet potatoes, but their peculiar shape makes them hard to dig. The plant is propagated by means of small tubers which are produced in immense numbers in the axils of the leaves, and on a rich loamy soil the yield of these tubers is often fifty or more bushels per acre. These tubers remain on the surface of the ground uninjured during ordinary winters, and so are a valuable winter food for hogs.

Chufa (*Cyperus esculentus*).—A perennial sedge that produces a large yield of small tubers which are a valuable food for hogs. It grows best on a sandy soil which has been well fertilized, where it makes a yield of from 75 to 100 bushels per acre. The tubers are planted in early spring, 12 to 15 inches apart in rows 3 to 4 feet apart, and



FIG. 15.—Canada field pea (*Pisum arvense*).

the only cultivation needed is to keep down grass and weeds. The tubers mature in October and November, and are easily rooted out by the hogs. Of little value on heavy soils.

Cowpea (*Vigna catjang*).—Well-known annual of unknown origin; cultivated throughout the South for more than one hundred years. Some varieties mature within sixty days from planting, while others will continue to grow until killed by frost. In planting it is better to select varieties which will mature a good part of the seed before time for frost. The heavier yield is secured by planting in drills and cultivating, but when seed is cheap and labor scarce a less expensive crop can be made by sowing broadcast. The better farmers always plant peas between the rows of corn at the last plowing, and the crop is one which can be grown with profit during any two months of warm weather when the land would otherwise be idle.

Crimson Clover (*Trifolium incarnatum*).—Annual; stems erect, somewhat branching, 1 to 2 feet; leaves numerous, obovate, rather large; flowers bright crimson, in long spikes.

Introduced from Europe; a valuable plant in nearly all of the country east of the Allegheny Mountains from New Jersey to Georgia, but has rarely succeeded well in any of the Gulf States. Seed should be sown in September or October at the rate of 20 pounds per acre, and where it grows well it can be grazed during the winter or cut for hay in the spring before the seed begins to mature. The plant has not proved generally valuable west of the Alleghanies, and in the South has rarely made a crop of any value, as the plants usually die during early winter. The matured plant is dangerous for feed as the stiff hairs on the calyx form balls in the stomachs of animals and often cause death.

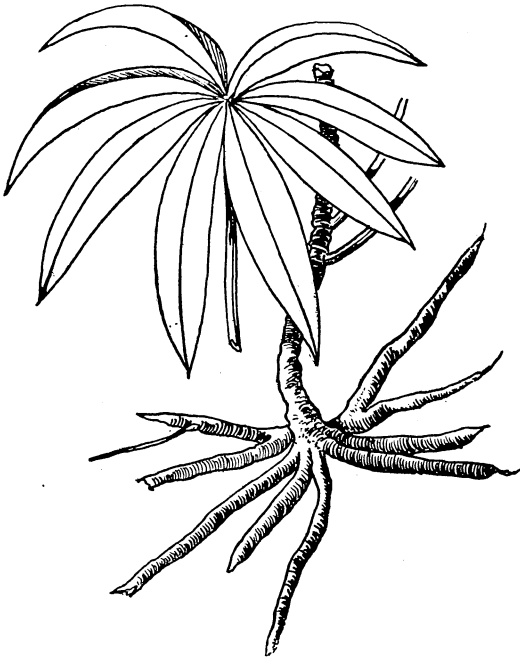


FIG. 16.—Cassava (*Manihot aipi*).

FLAT PEA (*Lathyrus sylvestris wagneri*).—Perennial; much like winter vetch in appearance.

This was introduced from Europe a few years ago, and extravagant claims were made for its luxuriant growth on the hardest and most sterile soils. It has been tested repeatedly at each of the Southern experiment stations and by hundreds of farmers, but has been uniformly disappointing. Its growth the first year from seed is rarely as much as 12 inches, and it requires the best of care to make it survive the summer. Older plants are more hardy and vigorous, but fail to hold the ground against native grasses and weeds, and soon disappear.

FLORIDA BEGGAR-WEED (*Desmodium tortuosum*).—Annual; stems erect, branching, 4 to 7 feet; leaflets 3, rhombic or elliptical, tomentose beneath, rough above; flowers small; legumes 1 to 1½ inches long, 3 to 6 jointed, rough-hairy.

Very common on sandy soils in Florida, and extending into South Georgia and Alabama; often planted and becoming naturalized along the coast farther west.

This is the best leguminous forage plant which has been found for light sandy soils, and it makes a vigorous growth on soils too light for most other crops. Its principal use is as a grazing plant, stock of all kinds grazing it freely and fattening rapidly where the plant is abundant. As it does not begin its growth until late in the spring and is killed by moderate frosts, it is valuable only during the summer and fall. It often grows as a volunteer with crab-grass and crowfoot on cultivated lands, and is then cut for hay. When used for hay, it should be cut when only 2 or 3 feet high, as the stems become hard and woody as the plant grows older. Besides its use as a hay and grazing plant it is a valuable fertilizing crop, and the seed is often scattered in corn fields at their last cultivation. When sown for hay, from six to eight pounds of seed are used per acre, and after land has once been seeded it seldom needs reseeding, though the plant never becomes a troublesome weed.

Several other species of *Desmodium* are found, usually in dry woodlands, throughout the entire region. Among the more common of these are *D. acuminatum*, *nudiflorum*, *pauciflorum*, and *viridiflorum*. All are eaten fairly well and add considerably to the woodland pastures, but are rarely abundant.

Groundnut (*Apios tuberosa*).—Perennial; stems climbing; leaflets 5 to 7, ovate or ovate-lanceolate; brownish-purple flowers in axillary racemes. Common in wooded swamps from Mississippi to Florida and northward. Eaten by all kinds of stock, hogs being very fond of the small tubers on the roots.

Hog Peanut (*Amphicarpæa monoica*).—Perennial; climbing; leaflets 3; flowers of two kinds—those on the stems in drooping racemes and sterile, those at the base fertile, fruiting underground. Occasional in rich, damp woods from Mississippi to Florida and northward. The vines are eaten by cattle, and hogs are fond of the underground nuts.

Horse Bean (*Faba vulgaris*).—Annual; stems erect, 2 to 3 feet; leaflets 3, oval, smooth and glaucous; flowers in small axillary clusters; pods 2 to 4 inches long.

Highly prized in Europe, but not successful here, as the plants are usually destroyed by blight at about the time they begin to bloom.

Jack Bean (*Canavalia ensiformis*).—Annual; stems erect, bushy, rather stout; leaflets 3, large; flowers few, in dense axillary racemes; pods 3 to 6 in a cluster, a foot or more in length; seeds large, white.

This came into notice about 1890, and since then has been planted in many places. The growth of the plant is all that could be asked, and the yield of beans is from 30 to 50 bushels per acre; but, unfortunately, neither the beans nor the plants are eaten well. At the Mississippi station the beans were fed in many ways—dry, soaked, ground into meal, and cooked—but neither horses, mules, cattle, nor hogs would eat them.

Japan Clover (*Lespedeza striata*) (fig. 17).—Annual; stem branching, slender and wiry, 3 to 24 inches; leaves very numerous, small; flowers small, in axillary clusters. This may be classed among the most valuable leguminous hay and pasture plants of the Gulf States. It is a native of Japan, which was introduced into this country about 1830, and is now thoroughly naturalized over the whole country south of the Ohio River. It grows on all soils, but does best on good loams containing a fair



FIG. 17.—Japan clover (*Lespedeza striata*).

amount of lime. It will also grow on hard, dry clay, and even where the soil is quite sandy. On thin soils its growth is very flat and spreading, while on better soil it becomes erect, and is often 2 feet in height. It endures heat and drought without injury, and stock eat it greedily. It never causes bloating, but occasionally has a slight salivating effect on horses, though that appears to occur in only a few localities. It starts late in the spring, but from May until after heavy frost it gives the best of grazing, and should be in every pasture. Although mostly used for grazing it is a valuable hay plant, making a good yield of from $1\frac{1}{2}$ to 2 tons per acre. When wanted for hay, it should be sown in early spring, at the rate of one-half bushel per acre, or it may be sown with oats in the fall, as it makes but little growth before the oats are harvested. For pastures it is necessary only to scarify the surface of the ground with a disk harrow, and it will often grow well without any

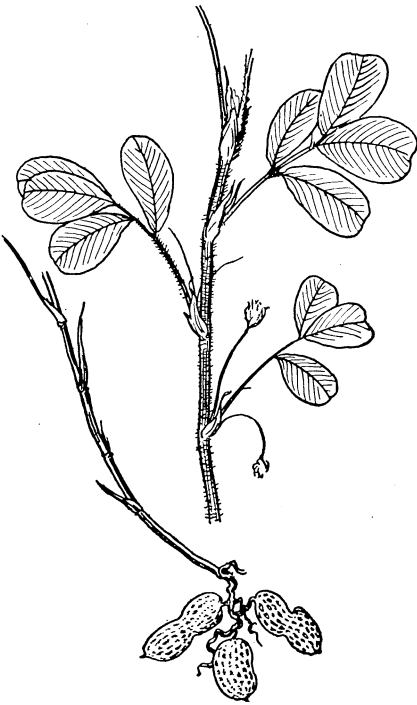


FIG. 18.—Peanut (*Arachis hypogaea*).

Where this and crab-grass grow together on well-fertilized soils the yield of hay is often two tons per acre, and costs nothing but the cutting. Feeders are somewhat divided as to its value, some claiming that it makes hay of fine quality, while others declare it to be worthless. Chemical analysis of the hay indicates that it is nearly or quite as rich a food as red clover, and it is certain that many animals keep in good condition through the winter with no other feed. It has but little value for grazing.

Milk Pea (*Galactia glabella*).—Annual; stems prostrate, 2 to 3 feet long, very slender; leaflets 3, rather rigid, 1 inch long; flowers large, reddish purple, 3 to 6 in a cluster.

Common on dry pine barrens and eaten well, but scarcely worth cultivating.

Eight or ten other species of *Galactia* are more or less abundant, usually in dry woods.

All are eaten freely, but their growth is too thin and scattering to make them of much value.

previous preparation of the soil. There are a number of native species of lespedeza which are quite common in dry, open lands throughout the South, and although all are grazed, they are not worth cultivating.

Kidney Bean (*Phaseolus diversifolius*).—Annual; stems prostrate or trailing, slender, 2 to 4 feet; leaflets 3, oval or 2 to 3 lobed; flowers purple, on long peduncles; pods long and slender.

Common on dry, sandy soil, affording some summer and fall grazing, but hardly worth cultivating.

Three other species of the same genus are quite widely distributed throughout the South, but are not sufficiently abundant to be of much importance.

Mexican Clover (*Richardsonia scabra*).—Annual; stems branching, diffuse 2 to 4 feet; leaves numerous, oval, rough; flowers nearly white, in small heads.

This is not a true clover, but takes its name from its habit of growth, which is much like that of red clover. It is a native of Mexico and Central America, but has become thoroughly naturalized along the Gulf coast, and is found occasionally as far north as central Mississippi and Georgia. A sandy soil seems essential to its vigorous growth in cultivated fields after other crops have been laid by.

Peanut (*Arachis hypogea*) (fig. 18).—Of some value for hay, and cultivated for hog pastures in all parts of the South. There are two very distinct types in cultivation, the "common" and the "Spanish." The former is the one which produces the peanut of commerce. The plant grows as straggling as a potato, and the nuts are produced on long peduncles and often quite scattered. This is seldom used for hay, though often grown for hogs. The Spanish variety is a smaller, more compact, and erect plant, which produces an immense number of very small nuts clustered closely at its base. This variety is growing in favor for hay, as the plant with its closely adhering nuts is easily pulled up. The yield is from 1 to 2 tons per acre,

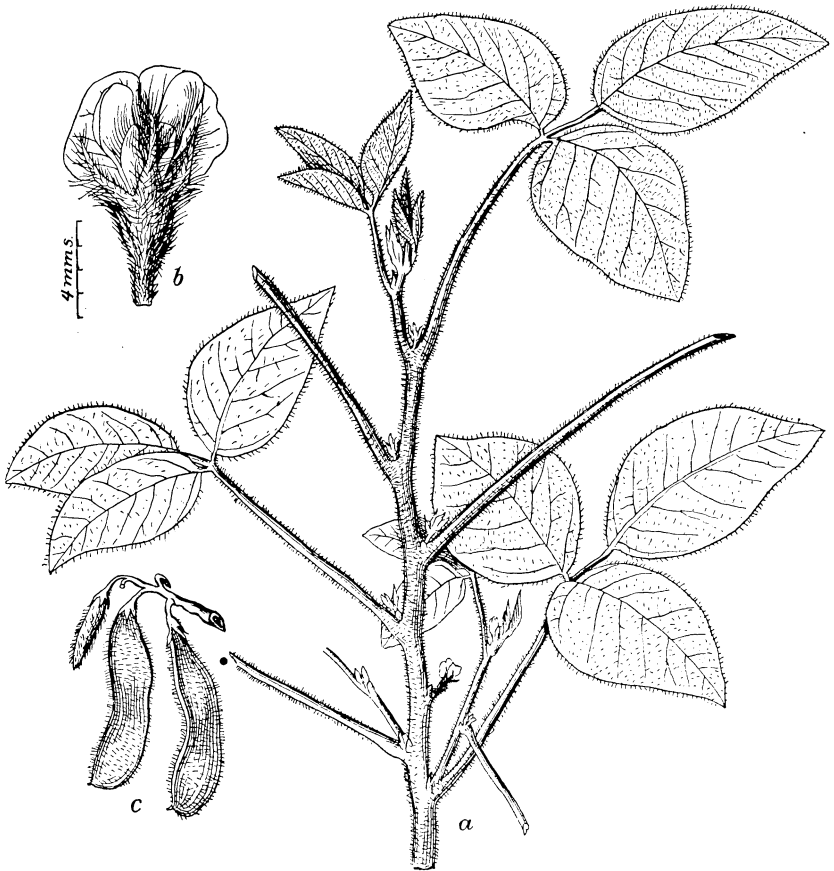


FIG. 19.—Soy Bean (*Glycine hispida*).

and as nearly half the weight is in the nuts, the hay is richer in protein than any other in common use. Either variety makes fine fall pasturage for hogs, and as the hogs do the harvesting, peanuts furnish the cheapest food for the season.

Prickly Comfrey (*Symphytum asperrimum*).—Perennial; stem erect, coarse, 2 to 4 feet; leaves very large and abundant, rough.

A very rank-growing plant which has been highly recommended for forage, especially for soiling. It is propagated by cuttings of the roots, which are planted about 18 inches apart in each direction and which continue to produce heavy crops of leaves for several years. Cattle do not eat the leaves readily until they become

accustomed to them, and there are other plants which are more profitable in the South.

Ramie (*Boehmeria nivea*).—Perennial; stem erect, coarse, 2 to 4 feet; leaves numerous, large; flowers very small and inconspicuous, in axillary clusters.

Although this is ordinarily cultivated as a fiber plant, it is grazed well by cattle and is an excellent crop for soiling. On rich soil it will give from three to six cuttings of the stems from 2 to 4 feet in height, and if cut before becoming mature they are so tender that the entire stalk is eaten. It is profitable only on rich soil, and does much better near the coast than farther north, as it needs a long season with abundant rains.

Red Clover (*Trifolium pratense*).—Red clover is becoming more popular each year, and is now quite a common crop in the black prairie region and in other sections where the soils contain a fair amount of lime. It requires a soil which is rich and in fairly good condition to insure a "catch" of the seed. On many soils where it makes a good start and yields two or three cuttings it soon becomes overrun with other plants and is choked out. It is the best of the family to occupy a good soil two or three years, but is of little value on poor soils. Seed should be sown in September at the rate of 10 to 12 pounds per acre, and it will then give a heavy cutting the following May. It succeeds best in the South when sown with no nurse crop.

Sedges (*Carices*).—Very similar to the true grasses in general appearance, but with the stems 3-angled and the leaves 3-ranked, while among the true grasses the stems are nearly round and the leaves are 2-ranked.

Usually on soils which are too wet and heavy for most of the true grasses, very common in swamps and tide marshes; nearly all are grazed when young, but as they approach maturity most species become so tough and tasteless that they are not touched by stock. The hay made from them is of poor quality, and one of the species is worth cultivating.

Soy Bean (*Glycine hispida*) (fig. 19).—Annual; stem stout, erect, branching but little, 2 to 4 feet; leaflets, 3; flowers in axillary clusters; pods short, 2 to 4 seeded; whole plant rough-hairy.

One of the staple crops of Japan, which attracted little attention in this country until about ten years ago, but is now becoming quite common. The crop is cultivated like corn, the seed being planted in drills at the rate of half a bushel per acre. The stems alone are too coarse to make good hay, but are covered with such a dense growth of leaves and are so prolific in fruit that the hay is prized highly, especially for milch cows and for fattening animals. The yield of green forage is very heavy when grown on good soil, and the yield of beans is from 20 to 30 bushels per acre. Those who have had most experience with this crop find that the best way to handle it is to cut or pull the plants when the first pods begin to open, and thrash as soon as dry enough. In this way the coarse stalks are so broken in pieces and mixed with the leaves and immature fruit that nearly all will be eaten. It is doubtless the best of the legumes for the silo, as it can be more easily handled for the cutter than can plants like clover or cowpeas. There are a number of varieties, differing mainly in the time of ripening and the color of the seeds.

Spurred Butterfly Pea (*Centrosema virginiana*).—Perennial; stems twining, 3 to 5 feet; leaflets, 3; flowers on short axillary peduncles, blue or purple, 1½ inches long; legumes, 4 to 6 inches long.

Common on dry soil in woods; eaten well, and might be worth planting in woodland pastures.

St. John's Bread; Carob Bean (*Ceratonia siliqua*).—A tree which is grown rather commonly in Florida, and occasionally farther west. It is valued for its sweet, fleshy pods, which are very rich in sugar, and so are good feed for fattening stock.

Sulla (*Hedysarum coronarium*).—Perennial; stem erect, branched, 4 to 6 feet; leaves very numerous, pinnate; flowers in large showy clusters.

A very deep-rooting plant which grows best on a well-drained soil. It makes a heavy yield in early spring, but is so tender that it can not be recommended except in Florida, as the plants are killed by frosts.

"When sown in the fall it makes an enormous growth during the winter, which is slightly injured by very severe frosts without being killed. Scarcely hardy enough for a winter crop, and yet not successful as a summer one."¹

Sweet Clover (*Melilotus alba*).—Biennial; stems erect, widely branched, 3 to 5 feet; leaves abundant, tri-foliolate; leaflets elliptical; flowers white, in slender spikes.

Common where the soil is rich in lime. Even on the white, rotten lime-stone hills in the black prairie region, where no other plants can grow, this makes a good yield. Its growth is much like that of a coarse alfalfa, but it will grow well on a much poorer soil and on one which is in poor mechanical condition provided it has an abundance of lime. It may be sown with Johnson grass, when it will make one cutting before the grass has much growth, and the later cuttings are heavier than when either plant is grown alone. It is an excellent pasture plant, beginning its growth in early spring. Cattle not accustomed to it do not always eat it readily at first, but if turned into the pastures before other vegetation furnishes much grazing they soon acquire a taste for it. The roots are very large and deep, and as they decay at the end of the second season they are fine fertilizers. Seed may be sown in either October or February. Usually but one cutting of hay can be made the first year, but the second season it will make three good cuttings. Although a biennial, a few plants will produce seed the first year and a few will live three years, so that land needs to be seeded but once to secure continuous occupancy by *melilotus*.

Sweet Potato (*Convolvulus edulis*).—The ranker-growing and coarser varieties of sweet potatoes are used largely for hog pastures, as the crop is one which can be grown with very little expense, and the harvesting is done by the hogs. The yield is often 200 bushels per acre, and the crop is one of the best and the cheapest that can be grown on sandy soil. The vines are sometimes saved for hay, but are hard to cure.

Velvet Bean (*Mucuna utilis*).—Annual; climbing stems sometimes 50 feet in length; leaflets 3, large; pods numerous, 2 to 3 inches long, each containing 3 or 4 large oval beans.

A newly introduced plant which has not been extensively tested, but which has been highly recommended by the experiment stations of Louisiana and Florida.

Vetches.—Six species of vetch are native to the Gulf States, two or three of which are very widely distributed, being quite common in open woods and along creek banks. All make their growth in late winter and early spring, and often are so abundant as to make considerable early grazing. None of the native species are worth cultivating as a field crop, but when seed can be gathered without too much labor it will pay to sow it on pasture lands.

DWARF VETCH (*Lathyrus pusillus*).—Annual; stem slender, nearly erect, 12 to 18 inches; leaves pinnate; peduncles long, 1- or 2-flowered; pods long, 12- to 15-seeded.

Common along roadsides and on dry soils. Good early grazing, but too dwarf for profitable cultivation.

HAIRY VETCH (*Vicia villosa*) (fig. 20).—Annual; stem straggling, much branched, 8 to 12 feet; leaves pinnate, very numerous, flowers purple, in erect racemes.

The best of the winter-growing legumes on a rich loam soil, but usually a failure on sandy lands. Seed should be sown in September or October at the rate of 1 bushel per acre. The growth is weak until January, when it begins to grow vigorously, and by March will usually make a mass of forage 2 feet deep. The seed matures in May or June, and the crop should be cut for hay as soon as the first pods ripen. The ground may then be plowed and cultivated for summer crops to be gathered by October, when the vetch seed scattered by the mowing will germinate

¹ Bul. No. 19, Louisiana experiment station.

and again cover the ground. The crop may be used either for grazing or for hay, and the yield of either is largely increased if oats are sown on the same ground.

SPRING VETCH OR TARES (*Vicia sativa*).—Annual; stems trailing, pubescent, 1 to 2 feet; leaves variable in shape, from obovate to linear; flowers axillary, in pairs, nearly sessile.

An introduced plant which is of considerable value for winter grazing and for growing with winter oats, but less prolific than the hairy vetch.



FIG. 20.—Hairy Vetch (*Vicia villosa*).

WINTER VETCH (*Lathyrus hirsutus*).—Annual; stem climbing or straggling, branching, 2 to 4 feet; leaves 3 to 6 in cluster; pods short, 2 seeded.

Introduced and naturalized in many places. Seed sown in September or October will germinate with the first autumn rains, though the plants make but little growth before January or February, after which they grow rapidly and cover the ground with a dense mass of forage by March or April. The plants bear grazing well, and reseed the ground freely. They will not bear quite as much frost as will the hairy vetch, but are eaten fully as well, and seem to be preferred by horses, though not by cattle. An excellent winter and spring pasture plant.

White Clover (*Trifolium repens*).—Uncertain and unreliable in its growth, sometimes covering the ground with a thick mat of vigorous plants, and then often disappearing for several seasons. A good grazing plant for cattle, but thought by some to be injurious to horses and mules.

Yellow Lupine (*Lupinus luteus*).—Annual; stem erect, stout, 2 to 3 feet; leaves numerous, palmately compound, large; flowers in large and showy terminal clusters.

This plant, unlike most other legumes, grows best on a soil containing but little lime, and so is especially valuable for the soils along the coast and for much of the pine-woods region. It affords good grazing, and the hay is valued as fully equal to that from red clover. The seed is high priced, and as from 75 to 100 pounds are required per acre the plant is not yet common, but is well worth planting experimentally on soils poor in lime. In Europe it is used successfully for renovating worn out sandy soils.

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